AMERICAN ZOOLOGIST

Volume 1, Number 4 November 1961

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PROGRAM

Winter Meeting of the American Society of Zoologists

December 28 through 30, 1961

Denver, Colorado

A brief synopsis of the program is given on pages 405 and 406 of this issue. One hundred seventy-five papers will be read in 31 sessions including 7 symposia, some of which have been organized by other societies. Fifty-four papers will be presented by title only.

Biologists' Smoker. A smoker for biologists has been organized for Wednesday evening in the South Lobby of the Grand Ballroom of the Denver Hilton Hotel. Biologists will be guests of local Zoology and Biology Departments.

Animal Behavior and Sociobiology. In addition to a one-session symposium on *Evolutionary Changes in the Hormonal and Neural Bases of Reproductive Behavior* (organized by William C. Young), this Division will hold 3 sessions of contributed papers. A business meeting will *not* be held.

Comparative Endocrinology. Together with the Division of Comparative Physiology this Division will cosponsor a three-session symposium on *Neurosecretion* (organized by Nancy S. Milburn). It will also have a one-session symposium on *Cellular Endocrinology* (organized by Paul A. Wright) and one session of contributed papers. A business meeting will be held.

Comparative Physiology. In addition to the three-session symposium on *Neurosecretion* cosponsored by this Division and the Division of Comparative Endocrinology, there will be 3 sessions of contributed papers and a business meeting.

Developmental Biology. Three sessions will be devoted to contributed papers and a business meeting will be held.

Invertebrate Zoology. Activities will be limited to one session of contributed papers in Invertebrate Zoology, Parasitology, and Protozoology. A business meeting will *not* be held.

Vertebrate Morphology. A one-session symposium on *Vertebrate Locomotion* (organized by D. Dwight Davis) will be followed by one session of contributed papers. A business meeting will be held.

Non-Divisional Session. There will be one session of contributed papers on Histology, Genetics, and Cytology.

Demonstrations: These will be open on Thursday morning and afternoon.

Zoologists' Dinner and Vice Presidential Address. Friday Evening. Dr. Jack Schultz of the Institute for Cancer Research, Philadelphia, will present the vice presidential address for Section F, AAAS.

Business Meeting of the American Society of Zoologists. The annual business meeting will be held Friday evening, immediately after the Zoologists' dinner.

Cosponsored and Other Symposia. The Society will cosponsor a four-session symposium on *Physiological and Biochemical Aspects of Human Genetics* (organized for Section N—Medical Sciences by Alexander G. Bearn and Oscar Touster), a three-session symposium on *The Data of Classification* (organized for the Society of Systematic Zoology by Richard Blackwelder), and a two-session symposium on *Biogeography of the Philippines* (organized for the Society of Systematic Zoology by Walter C. Brown, Alan E. Leviton and Charles F. Lytle). Attention of members of the Society is also directed to the Round Table Symposium on *Biochemical Phyletic Markers among the Protozoa* (organized by Seymour H. Hutner for the Society of Protozoologists).

Library and Book Lounge. Our Society is cosponsoring this exhibit of the Society of Systematic Zoology. All zoologists are invited to examine the extensive collection of books dealing with all aspects of animal science.

Chairmen and speakers are requested to keep the programs exactly on the published time schedule. If a speaker fails to appear, the free time may be used for further discussion or for a brief recess. Any speaker or presiding officer who finds at the last minute that he cannot attend the meeting should notify Ray L. Watterson, Program Officer of the Society, either at the Department of Zoology, Universiy of Illinois, Urbana or at the Denver Hilton Hotel.

LIST OF TITLES

Titles are arranged in the order of presentation with one exception. Papers to be presented by title only are listed last. The abstracts, which follow the list of titles, are arranged alphabetically by the name of the first author. All rooms listed are in the DENVER HILTON HOTEL.

WEDNESDAY AFTERNOON, DECEMBER 27

Library and Book Lounge. 1:00-9:00 P.M.

This exhibit of the Society of Systematic Zoology is cosponsored by the American Society of Zoologists.

Conference Room

Symposium: *The Data of Classification, I.* 2:00 P.M.

Denver Room

Organized by Richard E. Blackwelder, Southern Illinois University, for the Society of Systematic Zoology; cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences. Speakers and papers listed below will not necessarily appear in the order indicated; they will be distributed over three sessions. The sequence of speakers will be announced at Denver.

RICHARD E. BLACKWELDER, Southern Illinois University, *presiding*

1. ALEXANDER, RICHARD D., University of Michigan. Behavioral study in cricket classification. (30 min.)
2. BARR, THOMAS C., JR., University of Kentucky. Distributional data in troglobite classification. (30 min.)
3. BLAIR, W. FRANK, University of Texas. Non-morphological data in Anuran classification. (30 min.)
4. BOUDREAUX, H. B., Louisiana State University. Reproductive data in classification. (30 min.)
5. BOYDEN, ALAN A., Rutgers University. Precipitin testing and classification. (30 min.)
6. DOWNEY, JOHN C., Southern Illinois University. Host-plant relations as data for butterfly classification. (30 min.)
7. HUMPHREY, PHILIP S., Yale University. Anatomical data in duck classification. (30 min.)
8. KOHN, ALAN J., Florida State University. Ecological data in classification. (30 min.)
9. MILLER, ROBERT R., University of Michigan. Non-morphological data in fish classification. (30 min.)
10. PITELKA, FRANK A., University of California, Berkeley. Breeding systems in tundra shorebird classification. (30 min.)

11. RAUP, DAVID M., Johns Hopkins University. Crystallographic data in echinoderm classification. (30 min.)
12. SIBLEY, CHARLES G., Cornell University. Molecular structure of proteins as data for classification. (30 min.)
13. STAINS, HOWARD J., Southern Illinois University. Osteological data in mammal classification. (30 min.)

Round Table Symposium: *Biochemical Phyletic Markers among the Protozoa.*

2:00 P.M.

Junior Ballroom

Organized by Seymour H. Hutner, Haskins Laboratories, New York City, for the Society of Protozoologists.

SEYMOUR H. HUTNER, *presiding*

14. DOUGHERTY, ELLSWORTH C., University of California, Berkeley. Are there biochemical boundaries to a Phylum Protozoa?
15. HUTNER, SEYMOUR H., Haskins Laboratories, New York City. Which Protozoa (if any) should be called humanoid?
16. HOLZ, GEORGE C., JR., Syracuse University. Biochemical intimations of the phylogenetic position of the Ciliates.
17. JAHN, THEODORE L., University of California, Los Angeles. A biophysical look at Ameba taxonomy.

Meeting: Policy Committee of the American Society of Zoologists. 3:00 P.M.

Room 509

WEDNESDAY EVENING, DECEMBER 27

Meeting: Executive Committee of the American Society of Zoologists. 7:30 P.M.

Room 509

Biologists' Smoker. 9:00 P.M.

South Lobby of the Grand Ballroom

Arranged by Tyler A. Woolley, Colorado State University, and Paul Winston, University of Colorado. Financed by donations from Zoology and Biology Departments at Colorado State University, University of Colorado, University of Denver, Colorado College and Colorado State College.

THURSDAY MORNING, DECEMBER 28

Symposium: *Neurosecretion I.* 9:00 A.M.

Silver Room

Organized by Nancy S. Milburn, Tufts University, for the Divisions of Comparative Physiology and Comparative Endocrinology of the American Society of Zoologists. Cosponsored by the Society of General Physiologists and AAAS Section F—Zoological Sciences. No abstracts published for this symposium.

BERTA SCHARRER, Albert Einstein College of Medicine, *presiding*

9:00 18. SCHARRER, ERNST and STANLEY BROWN, Albert Einstein College of Medicine. Neurosecretion in *Lumbricus terrestris.* (25 min.)

9:35 19. MATSUMOTO, KUNIO, Okayama University, Japan. (Currently, University of Oregon). Experimental studies of the neurosecretory activities of the thoracic ganglion of a crab, *Hemigrapsus.* (25 min.)

10:10 20. MAYNARD, DONALD, University of Michigan. A thoracic neurosecretory complex in *Brachyura.* (25 min.)

10:45 21. COOKE, IAN, Harvard University. Effects of the pericardial neurosecretory substance on the crustacean heart. (25 min.)

11:20 22. SCHARRER, BERTA, Albert Einstein College of Medicine. The neurosecretory system of *Leucophaea maderae* and its role in neuroendocrine integration. (25 min.)

Symposium: *The Data of Classification, II.* 9:00 A.M.

Denver Room

Organized by Richard E. Blackwelder, Southern Illinois University, for the Society of Systematic Zoology; cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences. Speakers and topics to be selected from the list appearing in the program of the first session of this symposium.

RICHARD E. BLACKWELDER, Southern Illinois University, *presiding*

Section A: *Animal Behavior and Sociobiology, I.* 9:00 A.M.

Spruce Room

Joint session of the Division of Animal Behavior and Sociobiology and the Section of Animal Behavior and Sociobiology of the Ecological Society of America. Cosponsored by AAAS Section I—Psychology.

GEORGE BARLOW, University of Illinois, *presiding*

9:00 23. BACON, H. R., J. M. WARREN and M. W. SCHEIN, Pennsylvania State University. Reversal learning in chickens. (15 min.)

9:20 24. GOTTLIEB, GILBERT, Dorothea Dix Hospital, Raleigh, North Carolina.The relation of developmental age to auditory and visual imprinting. 15 min.) Paper cancelled.

9:40 25. GREENBERG, BERNARD, Roosevelt University. Parental behavior and imprinting in cichlid fishes. (15 min.)

10:00 26. BERNSTEIN, IRWIN S. and WILLIAM A. MASON, Yerkes Laboratories of Primate Biology, Inc. Aggression in a rhesus monkey group. (15 min.)

10:20 27. ALTMANN, STUART A., University of Alberta. The social play of rhesus monkeys. (15 min.)

10:40 28. JAY, PHYLLIS J., University of California, Berkeley. Dominance relations of the common Indian langur monkey. (15 min.)

11:00 29. DANE, BENJAMIN, Cornell University. (Currently at New York University Medical Center). A quantitative analysis of the display of the Goldeneye, *Bucephala clangula* (L). (Introduced by W. G. Van der Kloot) (15 min.)

11:20 30. BROWER, JANE VAN ZANDT and LINCOLN P. BROWER, Amherst College. Further experimental studies of mimicry of honeybees (*Apis mellifera*) by Syrphid flies (*Eristalis vinetorum*) with southern toads (*Bufo terrestris*) as predators. (15 min.)

Section B: *Histology, Cytology and Genetics.* 9:00 A.M.

Century Room

SHEILA J. COUNCE, Yale University, *presiding*

9:00 31. TWEEDELL, KENYON S., University of Notre Dame. Induced fluorescence of a frog renal adenocarcinoma grown in tissue culture. (15 min.)

9:20 32. ELIAS, HANS, and PAUL PEVSNER, Chicago Medical School. Architecture of the human pineal gland. (15 min.) Paper cancelled.

9:40 33. BAKER, C. L., Southwestern College. Spermateleosis in *Amphiuma tridactylum*. (15 min.)

10:00 34. MATTINGLY, SISTER M. AUGUSTINE, Oak Ridge National Laboratory and the Catholic University. Basic protein synthesis in the meristematic nucleus. (Introduced by R. J. Kimball) (10 min.)

10:15 35. LYTLE, CHARLES F., Tulane University. Ultrastructural specialization in the gastroderm cells of a hydromedusa. (15 min.)

10:35 36. EAKIN, RICHARD M., University of California, Berkeley. Fine structure of some little known photoreceptors. (15 min.)

10:55 37. KING, R. C. and R. P. MILLS, Northwestern University and Yale University. Nuclear-cytoplasmic exchange during oogenesis in *Drosophila*. (15 min.)

11:15 38. CASPARI, ERNST and HEINZ JOACHIM POHLEY, University of Rochester. Somatic mutations in *Ephestia* induced by purine analogues. (15 min.)

11:35 39. WRIGHT, THEODORE R. F., Johns Hopkins University. The genetic control of an esterase in *Drosophila melanogaster*. (15 min.)

11:55 40. YOON, CHAI HYUN, Boston College. Serum cholinesterase activities of neurological mutants in mice. (Introduced by Rev. William D. Sullivan, S. J.) (15 min.)

Section C: *Demonstrations*. 9:00 A.M.

Gold Room

41. MEYER, HERMANN, Colorado State University. Use of I.B.M. cards for custom-made bibliographic punch card systems.

42. VAN BREEMAN, V. L. and J. HIRAOKA, The Mercy Institute for Biomedical Research, Denver. Ultrastructure of nerve and satellite cells of spinal ganglia of rats treated with malononitrile.

Library and Book Lounge. 9:00 A.M.-9:00 P.M.

This exhibit of the Society of Systematic Zoology is cosponsored by the American Society of Zoologists.

Conference Room

THURSDAY AFTERNOON, DECEMBER 28

Symposium: *Neurosecretion, II*. 2:00 P.M.

Silver Room

Organized by Nancy S. Milburn, Tufts University, for the Divisions of Comparative Physiology and Comparative Endocrinology of the American Society of Zoologists. Cosponsored by the Society of General Physiologists and AAAS Section F—Zoological Sciences. No abstracts published for this symposium.

ERNST SCHARRER, Albert Einstein College of Medicine, *presiding*

2:00 43. WILLEY, ROBERT B. and GEORGE B. CHAPMAN, Ripon College and Cornell University Medical College. Fine structure of cells within the pars intercerebralis of *Blaberus craniifer* (Blattaria). (25 min.)

2:55 44. PIPA, RUDOLPH, University of California, Berkeley. A cytochemical study of neurosecretory and other neuroplasmic inclusions in *Periplaneta americana*. (25 min.)

3:10 45. BARTH, ROBERT, Harvard University. Neuroendocrine control of mating behavior in cockroaches. (Motion picture, 25 min.)

3:45 46. MILBURN, NANCY S., Tufts University. Control of efferent activity in the cockroach cercal ganglion by extracts of the corpora cardiaca. (25 min.)

Symposium: *The Data of Classification, III.* 2:00 P.M.

Denver Room

Organized by Richard E. Blackwelder, Southern Illinois University, for the Society of Systematic Zoology; cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences. Speakers and topics to be selected from the list appearing in the program of the first session of this symposium.

RICHARD E. BLACKWELDER, Southern Illinois University, *presiding*

Section C: *Demonstrations,* continued 2:00 P.M.

Gold Room

For list of papers, consult morning session of demonstration program.

Section D: *Animal Behavior and Sociobiology, II.* 2:00 P.M.

Spruce Room

Joint session of the Division of Animal Behavior and Sociobiology and the Section of Animal Behavior and Sociobiology of the Ecological Society of America. Cosponsored by AAAS Section I—Psychology.

BERNARD GREENBERG, Roosevelt University, *presiding*

2:00 47. BARLOW, GEORGE W., University of Illinois. Fanning in fishes as a measure of "intensity" of parental drive. (15 min.)

2:20 48. REISMAN, HOWARD M., University of California, Los Angeles. The reproductive behavior of the five-spined stickleback, *Eucalia inconstans* (Kirtland). (15 min.) Paper cancelled; presented by title only.

2:40 49. DIAMOND, MILTON, University of Kansas. Permanency of the "protective effect" of pregnancy toward behavioral and somatic modifications following injected androgen. (Introduced by W. C. Young) (15 min.)

3:00 50. DINGLE, HUGH, University of Michigan. The role of vision in the orientation of boxelder bugs on causeways. (15 min.)

3:20 51. SABELLI, H. C. and J. E. P. TOMAN, Chicago Medical School. Autonomic-like mechanisms modulating brain functions. (15 min.)

3:40 52. MULLIGAN, FR. JAMES, S. J., University of California, Berkeley. Physical structure of the song of the song sparrow. (15 min.)

4:00 53. COLLIAS, N. E., University of California, Los Angeles. A spectrographic study of the vocalizations of the village weaverbird, *Textor cucullatus*. (15 min.)

4:20 54. MACMILLEN, RICHARD E., Pomona College. The role of water in the population ecology of a southern California semidesert rodent fauna. (15 min.)

Section E: *Invertebrate Zoology, Parasitology and Protozoology.*

2:00 P.M.

Century Room

CLARENCE J. GOODNIGHT, Purdue University, *presiding*

2:00 55. MACRAE, EDITH KRUGELIS, College of Medicine, University of Illinois. The fine structure of planarian rhabdites. (15 min.)

2:20 56. COSTLOW, JOHN D., JR., Marine Laboratory, Duke University. Regeneration in larvae of *Callinectes*. (15 min.)

2:40 57. LEVINE, ESTEES P., Hopkins Marine Station, Stanford University. (Currently, San Jose State College). Some phlebobranch affinities of the structure, reproduction, development and concentration of metals in the aplousobranch ascidian, *Eudistoma ritteri*. (15 min.)

3:00 58. BOVEE, EUGENE C., GREGORY J. BOVEE, DAVID E. WILSON and SAM R. TELEFORD, JR., University of Florida. Amebiasis of tissues induced in mice and rats by inoculation with *Acanthamoeba* and *Entamoeba* spp. (15 min.)

3:20 59. HULL, ROBERT W., Northwestern University. Sensitivity of ciliated Protozoa to polycyclic hydrocarbon carcinogens. (15 min.)

3:40 60. LILLY, DANIEL M., BERNADETTE A. HERBST and ROSALIE H. STILLWELL, St. Johns University, New York. A reciprocal stimulating effect on growth in two species of ciliates. (15 min.)

4:00 60a. BUSHNELL, JOHN H., JR., Washington and Jefferson College. A reassignment of *Plumatella orbisperma* and information on the occurrence, variation and biology of the ectoprocta of Michigan. (15 min.) (No abstract)

Business Meeting: Division of Comparative Physiology of the American Society of Zoologists

4:30 P.M.

Silver Room

Business Meeting: Division of Developmental Biology of the American Society of Zoologists

4:30 P.M.

Century Room

THURSDAY EVENING, DECEMBER 28

AAAS General Meeting: Presidential Address and Reception-Smoker.

8:00 P.M.

Ballroom and Ballroom Foyer

Address of the retiring president of the AAAS, Chauncey D. Leake.

FRIDAY MORNING, DECEMBER 29

Symposium: *Neurosecretion*, III.

9:00 A.M.

Silver Room

Organized by Nancy S. Milburn, Tufts University, for the Divisions of Comparative Physiology and Comparative Endocrinology of the American Society of Zoologists. Cosponsored by the Society of General Physiologists and AAAS Section F—Zoological Sciences. No abstracts published for this symposium.

AUBREY GORBMAN, Barnard College, Columbia University, *presiding.*

9:00 61. BERN, HOWARD A. and NOBORU TAKASUGI, University of California, Berkeley. The caudal neurosecretory system of fishes. (25 min.)

9:35 62. BILLENSTIEN, DOROTHY C., Albert Einstein College of Medicine. (Currently, Colorado State University). The seasonal secretory cycle of the nucleus lateralis tuberis of the hypothalamus and its relation to reproduction in the eastern brook trout, *Salvelinus fontinalis*. (25 min.)

10:10 63. ETKIN, WILLIAM, Albert Einstein College of Medicine. Inhibitory control of pars intermedia activity by the brain. (25 min.)

10:45 64. FARNER, DONALD S. and ANDREAS OKSCHE, Washington State University and Anatomisches Institut der Universität Kiel. Neurosecretion in birds. (25 min.)

11:20 65. LEAF, ALEXANDER, Harvard Medical School and the Massachusetts General Hospital, Boston. Actions of neurohypophyseal hormones on the membrane of the toad bladder. (25 min.)

Symposium: *Vertebrate Locomotion.*

9:00 A.M.

Century Room

Organized by D. Dwight Davis, Chicago Natural History Museum, for the Division of Vertebrate Morphology of the American Society of Zoologists. Cosponsored by AAAS Section F—Zoological Sciences.

D. DWIGHT DAVIS, Chicago Natural History Museum, *presiding*

9:00 66. NURSALL, J. R., University of Alberta. Swimming and the origin of paired appendages. (25 min.)

9:25 70. WALTERS, VLADIMIR, University of California, Los Angeles. Discussion. Hydrodynamic models for the evolution of body form in scombroid fishes. (10 min.)

9:35 67. HILDEBRAND, MILTON, University of California, Davis. Walking, running and jumping. (25 min.)

10:00 67a. EATON, T. H., JR., University of Kansas. Discussion. (10 min.)

10:10 68. SAVILE, D. B. O., Plant Research Institute, Ottawa, Canada. Gliding and flight in vertebrates. (25 min.)

10:35 FISHER, HARVEY I., Southern Illinois University. Discussion. (10 min.) (No abstract)

10:45 69. GANS, CARL, University of Buffalo. Locomotion without limbs. (Motion picture, 25 min.)

11:10 AUFFENBERG, WALTER, University of Colorado. Discussion. (10 min.)

11:20 71. SNYDER, RICHARD C., University of Washington. Bipedal locomotion. (25 min.)

11:45 71a. DUBRUL, E. LLOYD, College of Medicine, University of Illinois. Discussion. (10 min.)

Symposium: *Physiological and Biochemical Aspects of Human Genetics,* I.

Structure and specific action of DNA.

9:00 A.M.

Junior Ballroom

Arranged for AAAS Section N—Medical Sciences by Alexander G. Bearn, the

Rockefeller Institute, and Oscar Touster, Vanderbilt University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

GUNTHER STENT, University of California, *presiding*

9:00		TOUSTER, OSCAR, Vanderbilt University. Introduction. (15 min.)
9:15	72.	MARMUR, J., Brandeis University. The biological aspects of the reversible denaturation of DNA. (30 min.)
9:45	73.	SINSHEIMER, R. L., California Institute of Technology. Studies of the process of replication of a single-stranded DNA. (30 min.)
10:15	74.	HURWITZ, J., New York University School of Medicine. The priming role of DNA and RNA in ribonucleic acid biosynthesis. (30 min.)
10:45	75.	MIRSKY, A. E., the Rockefeller Institute. The control of genetic activity. (30 min.)
11:15		Round Table Discussion. (35 min.)

Symposium: *Biogeography of the Philippines*, I.

9:00 A.M.

Colorado Room

Organized for the Society of Systematic Zoology by Walter C. Brown, Stanford University and Menlo College, Alan E. Leviton, California Academy of Sciences and Charles F. Lytle, Tulane University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

R. TUCKER ABBOTT, Academy of Natural Sciences of Philadelphia, *presiding*

9:00	76.	ABBOTT, R. TUCKER, Academy of Natural Sciences, Philadelphia. Introduction. (10 min.)
9:10	77.	CORBY, GRANT W., Petroleum Geologist and Engineer, Los Angeles. Geology and geological history. (30 min.)
9:40	78.	GLASSMAN, SIDNEY F., University of Illinois, Navy Pier, Chicago. Phytogeography. (30 min.)
10:10	79.	ABBOTT, R. TUCKER, Academy of Natural Sciences of Philadelphia. Recent mollusks. (30 min.)
10:40	80.	VOSS, GILBERT L., Marine Laboratory, University of Miami. Cephalopods. (30 min.)
11:10		General Discussion and Question Period.

Section F: *Animal Behavior and Sociobiology*, III.

9:00 A.M.

Spruce Room

Joint session of the Division of Animal Behavior and Sociobiology and the Sec-

tion of Animal Behavior and Sociobiology of the Ecological Society of America. Cosponsored by AAAS Section I—Psychology.

WILLIAM ETKIN, Albert Einstein College of Medicine, *presiding*

9:00 81. SCHEIN, M. W., Pennsylvania State University. Hallucinatory behavior in chickens evoked by brain stimulation. (Motion picture, 15 min.)

9:20 82. BROWER, LINCOLN P., FLORENCE P. CRANSTON and THOMAS E. PLISKE, Amherst College and Harvard Medical School. Further quantitative studies of courtship behavior in the queen butterfly, *Danaus berenice* (Cramer). (Motion picture, 15 min.)

9:40 83. DENNISTON, R. H. and PAUL D. MACLEAN, University of Wyoming and National Institutes of Health. Erection display in male-male and male-female interaction in the squirrel monkey, *Saimiri sciureus*. (Motion picture, 15 min.)

10:00 84. ETKIN, WILLIAM and MILTON DIAMOND, Albert Einstein College of Medicine and University of Kansas. The Japanese monkey center. (Motion picture, 25 min.)

Section G: *Developmental Biology*, I.

9:00 A.M.

Gold Room

ANTONE G. JACOBSON, University of Texas, *presiding*

9:00 85. SHELL, LESTER C., University of Dubuque. Distribution of sulfhydryl groups in development. (15 min.)

9:20 86. LINDSAY, DAVID T., Johns Hopkins University. Properties of lactate dehydrogenase isozymes from developing chicken tissue. (Introduced by C. L. Markert) (15 min.)

9:40 87. MORRILL, JOHN B., Wesleyan University. Electrophoretic separation of some soluble hydrolytic enzymes in the development of *Ilyanassa obsoleta*. (15 min.)

10:00 88. BERRY, MARGARET ANN, Indiana University. Separation, analysis and bio-assay of embryonic growth substances contained in yolk-albumen of the hen's egg. (Introduced by T. W. Torrey) (15 min.)

10:20 89. BLACKWOOD, UNABELLE B., Ohio State University. Changing teratogenic effect of 2-ethyl-5-methylbenzimidazole in the early chick embryo. (15 min.)

10:40 90. CLARK, RALPH M., JR. and HERBERT L. EASTLICK, Washington State University. Results obtained by injecting methylcholanthrene into the yolk sac of the twelve-day chick embryo. (15 min.)

11:00 91. THOMMES, ROBERT C. and CONRAD E. FIRLING, De Paul University. Effects of glucagon administration on blood glucose levels of the chick embryo. (15 min.)

11:20 92. METZ, CHARLES B. and HERBERT SCHUEL, Oceanographic Institute, Florida State University. Inhibition of agglutinability and fertilizing capacity of sea urchin sperm by papain-digested antibody. (15 min.)

11:40 93. OAKBERG, E. F. and EVELYN CLARK, Oak Ridge National Laboratory. Meiotic prophase stage and species differences in radiation response of the mammalian primary oocyte. (15 min.)

Library and Book Lounge. 9:00 A.M. - 9:00 P.M.

This exhibit of the Society of Systematic Zoology is cosponsored by the American Society of Zoologists.

Conference Room

FRIDAY AFTERNOON, DECEMBER 29

Symposium: *Evolutionary Changes in the Hormonal and Neural Bases of Reproductive Behavior.*

2:00 P.M.

Silver Room

Organized by William C. Young, University of Kansas, for the Division of Animal Behavior and Sociobiology of the Ecological Society of America. Cosponsored by AAAS Section F—Zoological Sciences and Section I—Psychology. No abstracts published for this symposium.

WILLIAM C. YOUNG, University of Kansas, *presiding*

2:00 94. ARONSON, LESTER R., American Museum of Natural History. Neural and hormonal factors in sexual behavior in lower vertebrates. (30 min.)

2:30 95. LEHRMAN, DANIEL S., Rutgers University. Physiological regulation of reproductive behavior in birds. (30 min.)

3:00 96. GOY, ROBERT W., University of Kansas and University of Wisconsin. Neural and hormonal factors in sexual behavior in mammals. (30 min.)

3:30 97. PRIBRAM, KARL H., Stanford University School of Medicine. Sex and the nervous system. (30 min.)

4:00 YOUNG, WILLIAM C., University of Kansas. Summarizing statements. (15 min.)

Symposium: *Physiological and Biochemical Aspects of Human Genetics*, II.

Gene-protein relationships, Part I.

1:30 P.M.

Junior Ballroom

Arranged for AAAS Section N—Medical Sciences by Alexander G. Bearn, the Rockefeller Institute, and Oscar Touster, Vanderbilt University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

A. G. BEARN, the Rockefeller Institute, *presiding*

1:30 98. NOVELLI, G. D., Oak Ridge National Laboratory. The role of gene-specific DNA in the cell-free synthesis of β-Galactosidase. (30 min.)
2:00 99. BONNER, D. M., University of California. The gene and protein structure. (30 min.)
2:30 100. BAGLIONI, C., Massachusetts Institute of Technology. Gene-protein relationships in human hemoglobin. (30 min.)
3:00 101. SMITHIES, O., University of Wisconsin. Genetic and biochemical aspects of haptoglobins. (30 min.)
3:30 Round Table Discussion. (35 min.)

Symposium: *Biogeography of the Philippines*, II.

2:00 P.M.

Colorado Room

Organized for the Society of Systematic Zoology by Walter C. Brown, Stanford University and Menlo College, Alan E. Leviton, California Academy of Sciences and Charles F. Lytle, Tulane University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

WALTER C. BROWN, Stanford University and Menlo College, *presiding*

2:00 102. MYERS, GEORGE S., Natural History Museum, Stanford University. Fresh-water fishes and Philippine zoogeography. (20 min.)
2:20 103. BROWN, WALTER C., Natural History Museum, Stanford University, and Menlo College. Reptiles. (30 min.)
2:50 104. PARKES, KENNETH C., Carnegie Museum. Birds. (30 min.)
3:20 105. JOHNSON, DAVID H., U. S. National Museum. Mammals. (30 min.)
3:50 BROWN, WALTER C., Natural History Museum, Stanford University, and Menlo College. Summary of the symposium, followed by general discussion and question period.

Section H: *Vertebrate Morphology.*

2:00 P.M.

Century Room

RICHARD C. SNYDER, University of Washington, *presiding*

2:00 106. HILDEBRAND, MILTON, University of California, Davis. Slow-motion studies of animal locomotion. (Motion picture, 30 min.) (No abstract)

2:40 107. GREGORY, P. W., L. M. JULIAN and W. S. TYLER, University of California, Davis. Comparisons of achondroplastic brachycephalic dwarf segregates from comprest and control stocks. (15 min.)

3:00 108. MEYER, HERMANN, Colorado State University. Cranio-encephalic morphology of the Wyoming ground squirrel, *Citellus richardsonii.* (10 min.)

3:15 109. NELSON, EDWARD M., School of Medicine, University of Puerto Rico. An adaptation for snapping in belonid fishes. (15 min.)

Section I: *Comparative Physiology,* I. *Arthropod physiology.*

2:00 P.M.

Spruce Room

NANCY S. MILBURN, Tufts University, *presiding*

2:00 110. BROCKWAY, ALAN PRIEST and HOWARD A. SCHNEIDERMAN, Western Reserve University. The effects of inert gases on the kinetics of gas exchange in the Cecropia silkmoth. (15 min.)

2:20 111. MAYNARD, D. M., M. J. COHEN and R. B. STEPHENS, Bermuda Biological Station, University of Michigan and University of Oregon. Functional connections in a regenerated heteromorphic antennule. (15 min.)

2:40 112. BARBER, SAUL B., Lehigh University. Responses of *Limulus* chemoreceptors to amino acid stimulation. (15 min.)

3:00 113. GWILLIAM, G. F. and JAMES CASE, Reed College and State University of Iowa. Amino acid sensitivity of the dactyl chemoreceptors of *Carcinides maenas.* (15 min.)

3:20 114. OWEN, WILLIAM B., University of Wyoming, The contact chemoreceptors of the mosquito, *Culiseta inornata* (Williston), and their role in feeding. (Introduced by L. Floyd Clarke) (15 min.)

3:40 115. HWANG, JOSEPH C. C., University of Oregon. The function of a second sensory cell group in the accessory-flexor proprioceptive system of crab limbs. (Introduced by Melvin J. Cohen, (15 min.)

4:00 116. WALCOTT, CHARLES, Harvard University. The spider vibration receptor and the spider web. (15 min.)

4:20 117. CASE, JAMES, State University of Iowa. Properties of the isolated ventilation regulating center of the cockroach, *Blaberus craniifer*. (15 min.)

Business Meeting: Division of Vertebrate Morphology of the American Society of Zoologists

4:45 P.M.

Century Room

FRIDAY EVENING, DECEMBER 29

Zoologists' Dinner and Vice Presidential Address,

AAAS Section F—Zoological Sciences.

6:00 P.M.

Silver and Gold Rooms, Combined

Arranged by George W. Wharton, Ohio State University, for Section F. Co-sponsored by the American Society of Zoologists, the Society of Systematic Zoology and the Society of Protozoologists.

C. LADD PROSSER, President, the American Society of Zoologists, *presiding*

Address: Human Values and Human Genetics.

Speaker: Jack Schultz, the Institute for Cancer Research, Philadelphia.

Vice President of AAAS Section F—Zoological Sciences.

Business Meeting: Annual business meeting of the American Society of Zoologists.
Immediately following the Zoologists' Dinner

Silver and Gold Rooms, Combined

Business Meeting: AAAS Section F—Zoological Sciences
Immediately following the business meeting of the American Society of Zoologists

Silver and Gold Rooms, Combined

SATURDAY MORNING, DECEMBER 30

Symposium: *Cellular Endocrinology.*

9:00 A.M.

Silver Room

Organized by Paul A. Wright University of New Hampshire, for the Division of Comparative Endocrinology. Cosponsored by AAAS Section F—Zoological Sciences.

PAUL A. WRIGHT, University of New Hampshire, *presiding*

9:00 118. WRIGHT, PAUL A., University of New Hampshire. Chairman's introductory remarks. (10 min.)
9:10 119. NOVALES, RONALD R., Northwestern University. The role of ionic factors in hormone action on the vertebrate melanophore. (30 min.)
9:45 120. TALMAGE, ROY V. and REIKO YOSHIDA, Rice University. Influence of the parathyroids on frog bone. (25 min.)
10:15 121. LARDY, HENRY and YA-PIN LEE, Institute for Enzyme Research, University of Wisconsin. Cellular effects of the thyroid hormone in different organs and species. (30 min.)
10:50 122. KOCHAKIAN, CHARLES D., University of Alabama Medical Center. Biochemical changes at the cellular level induced by androgens. (30 min.)
11:25 123. VILLEE, CLAUDE, Harvard Medical School. Mechanism of action of estrogens. (30 min.)

Sypmosium: *Physiological and Biochemical Aspects of Human Genetics,* III. *Gene-protein relationships,* Part II.

9:00 A.M.

Junior Ballroom

Arranged for AAAS Section N—Medical Sciences by Alexander G. Bearn, the Rockefeller Institute, and Oscar Touster, Vanderbilt University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

B. CHILDS, Johns Hopkins Hospital, *presiding*

9:00 124. STEINBERG, A. G., Western Reserve University. Genetic control of variations in gamma globulin. (30 min.)
9:30 125. KIRKMAN, H. N., University of Oklahoma Medical Center. Variants of human glucose-6-phosphate dehydrogenase. (30 min.)

10:00 126. MOTULSKY, A. G., University of Washington. Population genetics and glucose-6-phosphate dehydrogenase. (30 min.)
10:30 127. CEPPELLINI, R., University of Turin. Genetics and specificities of antibodies. (30 min.)
11:00 Round Table Discussion. (35 min.)

Section J: *Comparative Physiology*, II.

9:00 A.M.

Century Room

JAMES CASE, State University of Iowa, *presiding*

9:00 128. COHEN, M. J. and D. M. MAYNARD, Bermuda Biological Station, University of Oregon and University of Michigan. Convergence in units of the lobster brain. (15 min.)
9:20 129. MAYNARD, E. A., Bermuda Biological Station and University of Michigan. An electrophoretic study of esterases in the nervous systems of several decapod Crustacea. (15 min.)
9:40 130. WINSTON, PAUL W. and V. E. NELSON, University of Colorado. The uptake of atmospheric water by larvae of *Tribolium confusum*. (15 min.)
10:00 131. GREENBERG, MICHAEL J. and DONALD A. WINDSOR, University of Illinois. The responses of bivalve hearts to acetylcholine. (15 min.)
10:20 132. PHELPS, AUSTIN, University of Texas. Studies on factors influencing heat survival of a ciliate, a mite and an ostracod, obtained from a thermal stream. (10 min.)
10:35 133. JAHN, THEODORE L., MICHAEL BROWN and HOWARD WINET, University of California, Los Angeles. Pattern formation in cultures of *Tetrahymena*. (15 min.)
10:55 134. BELDEN, DON A., JR., and MYRON P. SMITH, University of Denver. A film illustrating surgical procedures for using the rat in mammalian physiology classes. (30 min.)

Section K: *Developmental Biology*, II.

9:00 A.M.

Gold Room

STEPHEN SUBTELNY, the Institute for Cancer Research, Philadelphia, *presiding*

9:00 135. DANIEL, JOSEPH C., JR., University of Colorado Medical Center. Reconstruction of rabbit blastocysts from fragments *in vitro*. (Motion picture, 15 min.)

9:20 136. LESSEPS, ROLAND, Johns Hopkins University. An electron microscopic study of dissociated embryonic cell surfaces. (Introduced by M. S. Steinberg) (15 min.)

9:40 137. KISCHER, C. WARD, Iowa State University. Fine structure of the developing down feather. (Introduced by John W. Saunders, Jr.) (15 min.)

10:00 138. LAWRENCE, IRVIN E., JR., University of Wyoming. Mesodermal-ectodermal interactions in the development of the comb. (Introduced by B. S. Wenger) (15 min.)

10:20 139. KOCH, WILLIAM E., Stanford University. Transmission of radioactive material during induction *in vitro*. (Introduced by C. Grobstein) (15 min.)

10:40 140. PEARSON, CLARE and JERRY J. KOLLROS, State University of Iowa. Spinal cord response to amputation of the hind limb in larval *Pseudacris*. (15 min.)

11:00 141. BOVBJERG, ANN M. and JERRY J. KOLLROS, State University of Iowa. Development of the skin glands in the frog, *Rana pipiens*, during treatment with thyroxine. (Introduced by Ray L. Watterson) (15 min.)

11:20 142. JACOBSON, ANTONE GARDNER, University of Texas. Factors influencing the positioning of the placodal derivatives in the newt. (15 min.)

11:40 143. FREEMAN, GARY and JANE OVERTON, University of Chicago. Lens regeneration from the cornea in *Xenopus laevis*. (15 min.)

12:00 144. CINTRON, CHARLES and DOUGLAS E. KELLY, University of Colorado. An analysis of pineal regeneration in developing newts. (15 min.)

Library and Book Lounge. 9:00 A.M.-9:00 P.M.

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Conference Room

SATURDAY AFTERNOON, DECEMBER 30

Business Meeting: Division of Comparative Endocrinology of the American Society of Zoologists.

1:00 P.M.

Silver Room

Symposium: *Physiological and Biochemical Aspects of Human Genetics*, IV. *Tissue culture, immunological and evolutionary aspects.*

1:30 P.M.

Junior Ballroom

Arranged for AAAS Section N—Medical Sciences by Alexander G. Bearn, the

Rockefeller Institute, and Oscar Touster, Vanderbilt University. Cosponsored by the American Society of Zoologists and AAAS Section F—Zoological Sciences.

T. DOBZHANSKY, Columbia University, *presiding*

1:30 YOUMANS, JOHN B., Director of Scientific Activities, American Medical Association. Genetic variations in human structure and function and their influence on medical care. (Vice-presidential address of AAAS Section N—Medical Sciences). Presentation of the 17th Theobald Smith Award given by Eli Lilly and Company.

2:30 145. PUCK, T. T., University of Colorado Medical Center. Genetic studies with human cells. (30 min.)

3:00 146. OWEN, R. D., California Institute of Technology. Immunological aspects of human genetics. (30 min.)

3:30 147. MARKERT, C. L., Johns Hopkins University. Origin and development of isozymes. (30 min.)

4:00 Round Table Discussion (35 min.)

Summarizer: T. DOBZHANSKY, Columbia University.

Section L: *Comparative Endocrinology.*

2:00 P.M.

Silver Room

DOROTHY PRICE, University of Chicago, *presiding*

2:00 148. HAGADORN, IRVINE R., University of California, Berkeley. Neurosecretory activity in the brain of a leech, *Theromyzon rude.* (Introduced by Howard A. Bern) (15 min.)

2:20 149. GILBERT, LAWRENCE I. and WILLIAM S. HERMAN, Northwestern University. The action of juvenile hormone extracts on the prothoracic glands of silkworm pupae. (15 min.)

2:40 150. DOANE, WINIFRED W., Yale University. Corpus allatum studies in adult *Drosophila melanogaster* and *Drosophila virilis.* (15 min.)

3:00 151. ORTMAN, ROBERT and KEVIN FALLON, Boston College. Localization of acid and alkaline phosphatase in the pituitary of *Rana catesbeiana* and *Rana pipiens.* (15 min.)

3:20 152. APLINGTON, H. W., Ohio State University. Thyroidectomy cells of *Necturus* hypophysis. (15 min.)

3:40 153. BAGNARA, JOSEPH T., University of Arizona. Stimulation of guanophores and melanophores by MSH peptides. (15 min.)

4:00 154. THURMOND, WILLIAM, California State Polytechnic College. A melanophore-stimulating substance in the hypothalamus of the tadpole and adult tree frog, *Hyla regilla.* (15 min.)

4:20 155. MAHER, MICHAEL J., Albert Einstein College of Medicine. The effect of environmental temperature on metabolic response to thyroxine in the lizard, *Lacerta muralis.* (10 min.)

4:35 156. ENDERS, ALLEN C., Rice University. Further studies concerning implantation in ovariectomized armadillos. (15 min.)

4:55 157. BLIVAISS, BEN B., RUSSELL O. HANSON and H. KUTUZOV, Chicago Medical School. Effect of ICSH on Leydig cells of testes in strain A mice. (15 min.)

5:15 158. PERRY, JAMES C., NANCY B. PERRY, JOHN G. SURAK and PETER SANFELIPPO, Marquette University. Recent advances in the study of induced polyarteritis nodosa. (Introduced by Paul A. Wright) (15 min.)

Section M: *Comparative Physiology*, III.

2:00 P.M.

Century Room

DONALD S. FARNER, Washington State University, *presiding*

2:00 159. MCCUTCHEON, F. HAROLD, University of Pennsylvania. Swimbladder volume control in pinfish, *Lagodon rhomboides* (Linn.). (15 min.)

2:20 160. MEIER, ALBERT H. and W. R. FLEMING, University of Missouri. Effects of pitocin and pitressin on water and sodium fluxes in the plains killifish, *Fundulus kansae*. (15 min.)

2:40 161. PFEIFFER, E. W. and H. A. BRAUN, Montana State University and Western Montana Clinic, Missoula. The effects of vasopressin on urine concentration of a mammal with few long loops of Henle and of a mammal with many long loops. (15 min.)

3:00 162. KLEEREKOPER, HERMAN, McMaster University. The role of chemical sense in the orientation of *Petromyzon marinus*. (Motion picture, 15 min.)

3:20 163. KING, DAVID B. and JAMES G. SNEDECOR, University of Massachusetts. Glycogen turnover in the chick glycogen body. (15 min.)

3:40 164. BENALLY, NANCY ROSE and MARVIN L. RIEDESEL, University of New Mexico. Metabolic rate and body weight of *Dipodomys* deprived of water. (15 min.)

4:00 165. ABRAMOFF, PETER, ANNAMMA P. COWNAN, SHIRLEY LIM SUE, MYUNG MOO CHOE and EDWARD CHAPERON, Marquette University. Preliminary studies of the effects of X-irradiation of the exteriorized circulating blood of rabbits. (15 min.)

4:20 166. GOLDBERG, ERWIN, J. POLAND, R. RENN, C. J. JOHNSON and C. NORMAN, North Dakota State University and West Virginia University. Susceptibility to stress of aging spermatozoa. (15 min.)

Session N: *Developmental Biology*, III.

2:00 P.M.

Gold Room

DOUGLAS E. KELLY, University of Colorado, *presiding*

2:00 167. SINCLAIR, JOHN G., Medical Branch, University of Texas. Collection

and study of early cetacean embryos. (Introduced by Raymond Blount) (15 min.)

2:20 168. JAFFEE, OSCAR CHARLES, University of Buffalo. On the morphogenesis of cardiac jelly and its role in the development of the heart. (12 min.)

2:37 169. DEHAAN, ROBERT L., Department of Embryology, Carnegie Institution of Washington. Time-lapse photographic analysis of migration of the precardiac mesoderm in the early chick embryo. (15 min.)

2:57 170. FERRAL, D. JOANNE, ELLSWORTH C. DOUGHERTY and BURTON BRODY, University of California, Berkeley, and Permanente Medical Group, Oakland. Conditions leading to lysis in axenically grown microannelids of the species *Enchytraeus fragmentosus* Bell, '59. (15 min.)

3:17 171. FERRAL, D. JOANNE, ELLSWORTH C. DOUGHERTY and BURTON BRODY, University of California, Berkeley, and Permanente Medical Group, Oakland. Conditions leading to tumor production in axenically grown microannelids of the species *Enchytraeus fragmentosus* Bell, '59. (Introduced by Wesley J. Birge) (15 min.)

3:37 172. SUBTELNY, STEPHEN and CAROLE BRADT, the Institute for Cancer Research, Philadelphia. Cytological observations on the early developmental stages of activated *Rana pipiens* eggs receiving a transplanted blastula nucleus. (15 min.)

3:57 173. COUNCE, S. J. and D. F. POULSON, Yale University. The developmental effects of hereditary infections in *Drosophila*. (15 min.)

4:17 174. GATES, ALLEN H., L. L. DOYLE and R. W. NOYES, Stanford University School of Medicine. A physiological basis for heterosis in hybrid mouse fetuses. (15 min.)

4:37 175. HAMILTON, HOWARD L. and C. WARD KISCHER, Iowa State University. Mitochondria and morphogenesis. (15 min.)

PAPERS READ BY TITLE

Papers read by title have been arranged alphabetically by the name of the first author.

176. ALTMANN, STUART A., University of Alberta. Adaptations of caribou to arctic conditions.
177. ARGYRIS, BERTIE F., Syracuse University. Induction of acquired tolerance with heavily X-irradiated spleen cells.
178. ARGYRIS, BERTIE F., Syracuse University. The capacity of X-irradiated spleen cells to produce acquired tolerance but eliminate runt disease in newborn mice.
179. ARGYRIS, THOMAS S., Syracuse University. Effect of unilateral nephrectomy or damage on mitotic activity in the contra-lateral kidney.
180. AUCLAIR, WALTER, University of Cincinnati. Natural incidence of renal adenocarcinoma in Vermont *Rana pipiens*.
181. BAKER, R. H. and J. B. KITZMILLER, University of Illinois. Induced copulation and chromosomal heterozygosity in *Anopheles*.
182. BARTH, LESTER G. and LUCENA JAEGER BARTH, Columbia University, Barnard College and the Marine Biological Laboratory. Further investigations of the differentiation *in vitro* of presumptive epidermis cells of the *Rana pipiens* gastrula.
183. BECK, SIDNEY L., Mammalian Genetics Center, University of Michigan. A system of polydactyly in the mouse.
184. BECK, SIDNEY L., Mammalian Genetics Center, University of Michigan. Genetic contribution to the eyeless phenotype.
185. BENNETT, MIRIAM F. and MAX RENNER, Sweet Briar College and Zoologisches Institut der Universität München. Variations in the collecting activity of honey bees under laboratory conditions.
186. BIRGE, WESLEY J., University of Illinois. Choroid plexus development in the chick embryo.
187. BOVEE, EUGENE C., DAVID E. WILSON and SAM R. TELFORD, JR., University of Florida. Entozoic amebas from feral reptiles.
188. CHAET, ALFRED B. and MICHAEL S. WEINSTOCK, the American University and the Marine Biological Laboratory. A toxin in the serum of scalded marine fish.
189. CHOE, MYUNG MOO and PETER ABRAMOFF, Marquette University. Relationship of blood volume to absorbed dosage in X-irradiation of the exteriorized circulating blood of rabbits.
190. COHEN, NATALIE S. and ALBERT S. GORDON, New York University. Studies on humoral regulation of eosinophil release and production.
191. COSTLOW, JOHN D., JR. and MURIEL I. SANDEEN, Duke Marine Laboratory and Duke University. The appearance of chromatophorotropic activity in the developing crab, *Sesarma reticulatum*.
192. CRISTOFALO, V. J. and R. R. RONKIN, University of Delaware. Respiration and motility in *Chlamydomonas*.

193. DEROOS, ROGER, University of California, Berkeley, and University of Missouri. *In vitro* corticoid production by the adrenal of the brown towhee, *Pipilo fuscus.*
194. DOWNS, WM. G., JR. and DAVID F. FITZPATRICK, Tennessee Polytechnic Institute. The lymphocyte as a criterion of degree of non-specific stress.
195. FINGERMAN, MILTON and R. NAGABHUSHANAM, Newcomb College, Tulane University. Proximal retinal pigment dark-adapting hormone in the eyestalk of the dwarf crayfish, *Cambarellus shufeldti.*
196. FINGERMAN, MILTON, R. NAGABHUSHANAM and LORALEE PHILPOTT, Newcomb College, Tulane University. Evidence for endocrine regulation of the proximal retinal pigment of the prawn, *Palaemonetes vulgaris,* based on alterations in rate of dark-adaptation.
197. FOX, HELEN and EDWIN A. MIRAND, Roswell Park Memorial Institute, Buffalo. Transmissibility of Friend Virus Disease to offspring by infected mothers.
198. FRENCH, W. L. and J. B. KITZMILLER, University of Illinois. Mosquito chromosome preparations using colchicine pretreatment.
199. HARTUNG, ERNEST W., University of Rhode Island. Studies on the homograft reaction in *Rana pipiens* utilizing C^{14} labeled glycine.
200. HARTUNG, ERNEST W. and C. J. LAFLAMME, University of Rhode Island. Homograft studies of the developing limb bud area of tadpoles of *Rana pipiens.*
201. JAHN, THEODORE L. and MICHAEL BROWN, University of California, Los Angeles. The mechanism of pattern formation in ciliate cultures.
202. JAKOWSKA, SOPHIE, New York Aquarium, New York Zoological Society. Syncoelous parabiosis of adult newts, *Diemictylus viridescens.*
203. JAKOWSKA, SOPHIE, ROSS F. NIGRELLI and ARNOLD H. SPARROW, New York Aquarium, New York Zoological Society and Brookhaven National Laboratory. Additional radiobiological studies on normal and anemic newts, *Diemictylus viridescens.*
204. KALLMAN, KLAUS D., New York Zoological Society. Genetic homogeneity of a small isolated population of viviparous fish as revealed by tissue transplantation.
205. LAMARCA, MICHAEL J. and PERRY W. GILBERT, Cornell University. The clasper and clasper gland of *Urolophus jamaicensis.*
206. LARSEN, JOSEPH R., JR., University of Pennsylvania. Fine structure of the chemosensory hairs of the blowfly, *Phormia regina.*
207. MACCHI, I. A., LELAND C. WYMAN, PATRICIA GRIFFIN and FRANK RIZZO, Boston University. *In vitro* adrenocortical response of regenerating rat adrenal mesenteric autografts to graded doses of Armour and Wilson adrenocorticotropin.
208. MACRAE, EDITH KRUGELIS, College of Medicine, University of Illinois. Incorporation of delta-aminolevulinic acid-4-C-14 into uroporphyrin-containing structures in *Dugesia dorotocephala.*
209. MARSLAND, DOUGLAS and ARTHUR M. ZIMMERMAN, New York University and State University of New York, Downstate Medical Center. An analysis of the anti-mitotic action of heavy water.
210. MAY, RAOUL MICHEL, BERNADETTE COURTEY and JEAN-PIERRE DENEFLE, Faculté des Sciences (Centre d'Orsay), University of Paris. *In vivo* observa-

tions on the transformation of medulloblasts into neurocytes in the chick embryo.

211. MAY, RAOUL MICHEL and JANINE THIMOTHEE, Faculté des Sciences (Centre d'Orsay), University of Paris. Action of various doses of X-rays on brephoplastic grafts of ovaries from a different strain in the mouse.
212. MIRAND, EDWIN A., Roswell Park Memorial Institute, Buffalo. Further evidence that the spleen is necessary to produce the erythropoietic syndrome in Friend Virus Disease.
213. ORTMAN, ROBERT, Boston College. A note on the cytology of the pituitary of *Gadus morrhua*.
214. PIKO, LAJOS, California Institute of Technology. Fertilization in the Chinese hamster after normal matings.
215. PIKO, LAJOS, California Institute of Technology. Repeated fertilization of fertilized rat eggs after treatment with versene (EDTA).
216. PRICE, DOROTHY and JAN MARTAN, University of Chicago and University of Oregon. The supracaudal gland of the female guinea pig.
217. RULON, OLIN, Northwestern University. Cobalt and versene in the extension of fertilizability in sand dollar eggs.
218. SANDEEN, MURIEL I., Duke University. The influences of eyestalk removal and nervous system extracts on the motor activity of the fiddler crab, *Uca pugilator*.
219. SNEDECOR, JAMES G., GEORGE E. GHAREEB and DAVID B. KING, University of Massachusetts. *In vitro* studies of chick glycogen body.
220. TAYLOR, KENNETH and HAROLD M. KAPLAN, Southern Illinois University. Histologic structure of turtle blood cells.
221. TERRACINI, EMMA D. and FRANK A. BROWN, JR., Northwestern University. Periodisms in mouse 'spontaneous' activity.
222. TICER, J. W., W. S. TYLER, L. M. JULIAN and P. W. GREGORY, University of California, Davis. Influence of achondroplasia on the width and cell content of an epiphyseal line.
223. TURBYFILL, CHARLES L., ROY P. PETERSON and A. L. SODERWALL, University of Oregon. Differential effects of filtered and non-filtered X-rays on the golden hamster.
224. VANKIN, G. LAWRENCE and H. CLARK DALTON, New York University. Embryonic grafting and drug experiments on melanophores involved in tail darkening of hypophysectomized urodele larvae.
225. VAN WEEL, P. B. and ERNEST T. TAKAFUJI, University of Hawaii. Effects of cations on the heart beat of *Achatina fulica* Bowdich.
226. WALTON, ARTHUR C., Knox College. The amphibia as hosts of cestodes and acanthocephala.
227. WATERMAN, ALLYN J., Williams College. Thyroid gland of the young alligator, *A. mississippiensis*.
228. WATERMAN, ALLYN J., Williams College. Thyroid gland of the young "slider" turtle, *Pseudemys scripta*.
229. WILBER, CHARLES G., Kent State University. Some time relations of the electrocardiogram in reptiles.

Abstracts

Abstracts are arranged in a single sequence alphabetically according to the last name of the first author. Papers 176 to 229 are read by title. The number of an abstract will give a clue to its location in the program. An author index follows the abstracts.

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PETER ABRAMOFF, ANNAMMA P. COWNAN, SHIRLEY LIM SUE, MYUNG MOO CHOE, and EDWARD CHAPERON, Marquette University. Preliminary studies of the effects of X-irradiation of the exteriorized circulating blood of rabbits. (15 min.)

The effects of X-irradiation of the exteriorized circulating blood of rabbits on their serum proteins, lymphoid tissues and antibody production have been analyzed. Animals irradiated in this manner and receiving a series of bovine serum albumin injections showed an increase in the time for antigen elimination as well as a decrease in the mean peak titer. Furthermore, electrophoretic analyses of the serum protein changes showed a decrease in the albumins and an increase of the alpha and beta globulins following such treatment.

X-irradiation of the exteriorized circulating blood decreases the over-all splenic activity as indicated by the depletion of the germinal centers and the absence of mitotic activity. The demarcation of lymphoid follicles into the germinal center, mantle layer and marginal zone was also disrupted.

The preliminary results of this study, therefore, tend to indicate that the effects of this form of irradiation on the antibody response are comparable to those found in whole body irradiation studies. However, the damage is less intense and this variation in intensity may be attributed to the irradiation dosage, which, in this experiment, is less than those used in whole body irradiation studies. (Supported by grant AT(11-1)-820 from the U.S.A.E.C.)

176

STUART A. ALTMANN, University of Alberta. Adaptations of caribou to arctic conditions.

Caribou are the most widespread and abundant artiodactyls in the arctic. Their adaptations to boreal conditions include their migratory pattern, the timing and routes of their migrations, the insulating abilities of their fur, the structure of their hooves, the composition of their milk, their selection of microhabitats, the annual timing of their estrus, the duration of pregnancy, their rapid growth and maturation, and the social bond between mother and infant. (Supported by Canadian Wildlife Service.)

27

STUART A. ALTMANN, University of Alberta. The social play of rhesus monkeys. (15 min.)

Social interactions among playing rhesus monkeys were observed during a two-year field study. Play was initiated and maintained by means of metacommunicative messages that enabled the monkeys to distinguish between play and non-play situations. About 51% of the players were males between the ages of 1 and 3. The play groups included about twice as many males as females. These play groups tended to consist of like-aged individuals. Possible sources of this age stability include: (1) "friendships" that may have been established during infancy among the progeny of closely associated adult females and (2) a tendency of monkeys not to participate in "games" unless they are "fair games," in which the participants had a reasonable expectation of winning the play-aggressive contests. In playing with younger monkeys, older monkeys made the games fair by "self-handicapping": they played no more roughly than the younger monkeys would tolerate within the context of play. (Supported by research fellowship MF-9005 from the U.S.P.H.S., and by grant PRA-156 from the N.R.C. of Canada.)

152

H. W. APLINGTON, Ohio State University. Thyroidectomy cells of *Necturus* hypophysis. (15 min.)

Following thyroidectomy during the control or static period (Jan.-Mar.) of the pituitary year cycle, a distinctive cellular variation appears in the pars buccalis of the *Necturus* hypophysis. Identified with Masson's stain after Helly fixation, these cells exhibit a profusion of coarse, red cytoplasmic granules (1-2 μ) against a finely particulate lavender-blue background. The background material is PAS and AF positive like that of other pituitary basophiles but the acidophilic granules retain the Orange G of the counterstains used after these techniques.

These cells are located predominantly in the cephalic half of the pars buccalis, diminishing abruptly in number as their distribution overlaps with the basophilic bed and transitional zone. They range in shape from long to irregularly oval, depending on their sinusoidal orientation or lack of it, and may attain a size of approximately 45x 18x15μ. Vacuolation accompanied by degranulation occurs in both larger and smaller cells.

Detectable one to two weeks after operation, these thyroidectomy cells have been traced back to their source: 1) to normally occurring purple basophiles (Masson) which undergo tinctorial alterations as the granules appear in their cytoplasm and 2) to a reservoir of undifferentiated cells which, depending upon their location, either pass through a purple phase or differentiate directly into thyroidectomy cells. This and other evidence strongly suggests that the purple basophiles are the thyrotrophs of the *Necturus* hypophysis. (Supported by grant A-2428 from the U.S.P.H.S.)

177

BERTIE F. ARGYRIS, Syracuse University. Induction of acquired tolerance with heavily X-irradiated spleen cells.

The injection of homologous spleen cells into newborn mice can result in acquired tolerance. Experimental evidence has shown that adult tolerant mice harbor both host and donor cells in their spleen and lymph nodes, indicating that the donor cells have proliferated and colonized host tissues. This suggests that the presence of donor cells may be required for maintaining the tolerant state. The experiment below, which is designed to test this hypothesis, utilizes heavily X-irradiated spleen cells in an attempt to induce acquired tolerance to skin homografts. Such X-irradiated cells, although still antigenic, are incapable of proliferating or surviving for any extended period after injection. Our results indicate that one single intravenous injection of 5-7 x 10^6 spleen cells from CBA donors, which had received 950 r total body irradiation, fails to induce acquired tolerance in newborn C3H mice. But 4 repeated injections, alternating intravenously and intraperitoneally, of such X-irradiated spleen cell preparations into C3H mice on the 1st, 2nd, 3rd and 4th day after birth results in acquired tolerance, as manifested by the successful "take" of CBA skin homografts, 2 months later.

These results suggest that the colonization of donor cells is not required for maintenance of acquired tolerance to homologous skin grafts.

178

BERTIE F. ARGYRIS, Syracuse University. The capacity of X-irradiated spleen cells to produce acquired tolerance but eliminate runt disease in newborn mice.

Injection of homologous spleen cells into newborn mice results in acquired tolerance and/or runt disease. Runt disease is believed to be due to a graft versus host reaction because embryonic or adult F_1 hybrid cells, which are incapable of reacting immunologically to host antigens, can produce tolerance without runt disease. We have tested the capacity of X-irradiated spleen cells to produce tolerance without runt disease. Intravenous injection of 5-9 x 10^6 spleen cells from normal CBA donors into newborn C57B1/6 mice, results in 100% runt disease. Injection of spleen cells from CBA donors, X-irradiated with 200, 300 or 400 r (total body) results in 60, 10 or 0% runt disease, respectively. However, spleen cells from donors, irradiated with 400 r are still capable of inducing tolerance in 76% C3H mice, a strain combination which yields 97% tolerance with non-irradiated spleen cells. When spleen cells are destroyed by heavy doses of total body irradiation (950 r), a single injection of 5 x 10^6 cells fails to induce tolerance in C3H mice.

These results suggest that *in vivo* X-irradiation of CBA mice with 300 or 400 r inhibits antibody production to tissue antigens, as measured by the absence of runt disease in C57B1/6 mice but does not eliminate the capacity of the spleen cells to induce tolerance in C3H mice.

179

THOMAS S. ARGYRIS, Syracuse University. Effect of unilateral nephrectomy or damage on mitotic activity in the contra-lateral kidney.

Mitotic activity was determined in intact and in unilaterally nephrectomized C57/B16 mice 2 days after removal of the right kidney. Mice were injected with 0.1 mg of colchicine in 0.25 cc of saline 6 hours prior to sacrifice. Mitotic activity (number of mitoses/100 high power fields; approximately 100,000 cells) in the left kidney of control mice averaged 7 (range 3-9), and in the unilaterally nephrectomized mice it was markedly increased, averaging 57 (range 50-65).

To determine if damage to the kidney could result in a similar increase in mitotic activity in the contra-lateral kidney, the right kidney cortex was damaged by the insertion of a hypodermic needle (No. 23). Two days later the mice were given colchicine as described above and sacrificed 6 hours later. Mitotic activity of the contra-lateral kidney was dramatically increased, averaging 54 (range 36-72).

These experiments suggest that a small amount of damage to one kidney can result in the stimulation of mitotic activity in the contra-lateral kidney to the same extent as seen after unilateral nephrectomy. (Supported by N.S.F. grant G-13945.)

180

WALTER AUCLAIR, University of Cincinnati. Natural incidence of renal adenocarcinoma in Vermont *Rana pipiens*.

A population survey was made at four different sites in the Alburg, Vermont area north of Lake Champlain for renal adenocarcinomas in frogs. At least fifty frogs from each locale were collected as they emerged from hibernation. The four well-separated areas were: (1) a tributary of the Pike River, 15 miles north of Alburg in Canada; (2) the Swanton River near Alburg; (3) a swamp outside of St. Albans, Vermont beside Lake Champlain, about 15 miles southeast of Alburg; (4) a polluted swamp on the island of South Hero, 15 miles south of Alburg in Lake Champlain.

The incidence of renal tumor-bearing frogs from the first three areas was 4 to 5.5 per cent, none being found in South Hero. Carcinomas were found in the spleen and gall bladder of single frogs from the Swanton and Pike River locales, respectively.

Parasitic eggs were found in the abdominal cavity of 26 to 35 per cent of the animals in the first three areas, and only 20 per cent from the last, either attached to or imbedded in the organs and peritoneum or free-floating. Ten to fifteen per cent of the animals from each locale had one or more parasitic eggs within a kidney, resembling minute tumors.

These preliminary data indicate the possibility of a parasite which could act as a vector within a geographic area to transmit a species-specific, organ-specific tumor-inducing agent. (Supported by U.S.P.H.S. Post-doctoral Research Fellowship, CF-12,861.)

23

H. R. BACON, J. M. WARREN and M. W. SCHEIN, Pennsylvania State University. Reversal learning in chickens. (15 min.)

Eight normal White Leghorn hens were tested on 20 nonspatial discrimination reversals, using stimuli that differed in multiple visual dimensions. These Ss were tested in their "home environment", using a modified correctional method. Rapid reduction of errors took place after the second reversal. There were 25 instances of single error reversals out of the 160 reversals run, with the

mean errors for all reversals being 12. An additional 23 reversal problems were run as controls for extraneous cues, and as a determination of cue value for the different features of the stimuli. The error scores remained low (mean=6) for these reversals, except where elimination of several features of the stimuli eliminated the Ss ability to discriminate between them. Thus, chickens like mammals show a progressive improvement in performance on serial reversals, an ability not previously demonstrated in non-mammalian species.

153

JOSEPH T. BAGNARA, University of Arizona. Stimulation of guanophores and melanophores by MSH peptides. (15 min.)

Both guanophores and melanophores are under the influence of hypophyseal chromatotrophic hormone (CTH, MSH, intermedin, etc.). This principle causes melanophores to expand and guanophores to contract. In order to determine if the same parts of the hormone molecule are involved in evoking these differing chromatophore responses, the efficacy of various MSH peptides was tested on hypophysioprivic larvae of *Rana pipiens*. Peptides were obtained through the courtesy of C. H. Li and K. Hofmann and included two pentapeptides, a hexapeptide, a heptapeptide, an octapeptide, two decapeptides, bovine α-MSH, bovine β-MSH, and synthetic α-MSH. On the basis of both minimal effective dose and duration of reaction, the ability of each of these peptides to stimulate either guanophores or melanophores was not altered, and in no case did a peptide stimulate one type of chromatophore without affecting the other to a proportional degree. The same proportional degree of response holds to peptides that have been potentiated by treatment with alkali. These results imply that the same part of the MSH molecule is involved in two different responses: guanophore contraction and melanophore expansion. (Supported by grant G-6231 from N.S.F.)

33

C. L. BAKER, Southwestern College. Spermateleosis in *Amphiuma tridactylum*.

Spermatid has prominent acroblast, centriole and ring. Acroblast secretes acrosome that becomes seated on periphery of nucleus. Centriole (proximal of other forms) gives rise to slender filament that lengthens into axial filament encircled by ring (distal centriole of others) that remains as such until after nucleus elongates and condenses. As nucleus elongates acrosome gradually changes from sphere to cone. Opposite end of elongating nucleus shrinks slightly and produces densely staining granule that soon enlarges to form neck closely appressed to nucleus. Axial filament then makes permanent contact with neck. Ring elongates along axial filament as a pessary-shape extending through middle piece behind the advancing cell membrane, and then disappears as mitochondria appear and surround axial filament throughout the middle piece. As axial filament lengthens it becomes flat with two bars, one crescent in cross-section, the other oval, connected by a thin fin; both extending from neck throughout middle and principal pieces. Flagellum arises from centriole posterior to neck, extends along grooved bar and becomes a marginal filament of an undulating membrane extending entire length of sheathed axial filament and beyond for short distance as an unsheathed free tail. The only evidence of motility is the vibratile flagellum. (Supported by grant RG-7209 from the U.S.P.H.S.)

181

R. H. BAKER and J. B. KITZMILLER, University of Illinois. Induced copulation and chromosomal heterozygosity in *Anopheles*.

Pre-treatment with lower than normal (27°C) rearing temperatures greatly enchances the success of the Horsfall induced copulation technique with *Anopheles* mosquitoes. Males are kept at 21°C for one day prior to attempted copulation. After this time induced copulation succeeds in more than 90% of the attempts. At the present time, laboratory stocks of *Anopheles quadrimaculatus, A. punctipennis, A. freeborni, A. earlei* and *A. albimanus* can be maintained by induced copulation. We are confident that the same technique will produce fertilization in other species of *Anopheles*. The technique is presently being used to investigate structural heterozygosity in salivary gland chromosomes in hybrids of the species mentioned above as well as in the investigation of chromosomal polymorphism which occurs in different geographic strains within *A. quadrimaculatus* and *A. punctipennis*. (Supported by grant E-3486 from the U.S.P.H.S.)

112

SAUL B. BARBER, Lehigh University. Responses of *Limulus* chemoreceptors to amino acid stimulation. (15 min.)

The sensitivity of *Limulus* gnathobase chemoreceptors was studied by analyzing multiple-unit spike potential activity recorded from small bundles of the appropriate nerve. Most units respond to chemical stimulation with irregular, repetitive bursts of spikes. Strength of response is signaled by "intra-burst" frequency and duration as well as by "inter-burst" frequency.

Aqueous extracts of marine bivalves yield the strongest responses and some individual amino acid solutions (0.5 M in sea water) produce similar, but weaker, responses. Only glycine consistently activated the same units, usually with weaker activity, as the extracts. Proline or taurine, or both, often, but not always, excited the same units as glycine; whereas alanine and sodium glutamate were the least stimulating. On the other hand, an equimolar mixture of the five amino acids (0.1 M for each) often elicited stronger unit responses than 0.5 M glycine alone. This suggests that the activity of some units is increased by peripheral summation at two or more separate stimulation sites.

The stimulating capacities of DL, D and L alanine were compared and no differences among them were found. Likewise no consistent differences in stimulating strength were found among amino acids dissolved in sea water and those with distilled water as solvent. It is possible, however, that prolonged exposure to distilled water solutions has an injurious effect on the receptors. (Supported by grant B-1389 from the U.S.P.H.S.)

47

GEORGE W. BARLOW, University of Illinois. Fanning in fishes as a measure of "intensity" of parental drive. (15 min.)

Fishes exhibit a spectrum of parental behavior from none to an advanced state. Fanning is the most easily quantified activity of this behavioral complex; it serves to ventilate the clutch and has been independently evolved in many groups.

Jan van Iersel (1953) used total fanning time, and duration of fanning bouts, in his investigation of the three-spined stickleback; duration was correlated positively with "high intensity" of parental drive. Using this parameter, similar curves were obtained by me for the fishes *Badis badis* and *Etroplus maculatus*. But when the tempo of fanning was analyzed, it mirrored crudely the curves for time fanned. These measurements, plus changes in color, rate of yawning, and attachment to the clutch, indicate the close affinity of sexual and parental behavior in *Badis badis*, and the emancipation of parental behavior in *Etroplus maculatus*. The notion of unitary drive is difficult to apply in this situation. (Supported by post-doctoral fellowship MF-8244 from the U.S.P.H.S.)

182

LESTER G. BARTH and LUCENA JAEGER BARTH, Columbia University, Barnard College and the Marine Biological Laboratory. Further investigations of the differentiation *in vitro* of presumptive epidermis cells of the *Rana pipiens* gastrula.

Presumptive epidermis cells cultured as small aggregates have been induced to express a variety of types of differentiation without recourse to addition of specific high molecular weight inductor substances.

Types of cellular differentiation observed range from epithelial sheets and ciliated swimming masses, through three types of nerve tentatively diagnosed as representing nerve patterns characteristic of brain, spinal cord and ganglia, respectively, to melanocytes, notochord and muscle.

The most drastic shift in expression of differentiation potencies (presumptive epidermis into muscle) has been obtained with lithium chloride when eggs raised in the presence of this salt are used as donors of presumptive epidermis cells followed by further treatment with lithium chloride before culture. Although the biochemical basis for the alteration in differentiation is unknown, the fact that a graded series of differentiation potencies can be brought to expression by varying concentrations and durations of treatment has been ascertained.

Further evidence that a single compound at graded doses and exposures can evoke a range of different responses comes from the data on ammonia and sodium thioglycollate. Both the ammonium ion and sulfhydryl groups may be expected to play a role in reactions that proceed in the intact presumptive epidermis of the living gastrula. (Supported by grant RG-3322 from the U.S.P.H.S.)

183

SIDNEY L. BECK, Mammalian Genetics Center, University of Michigan. A system of polydactyly in the mouse.

A syndrome of preaxial polydactyly of the hind foot in the ZRDCT lines of the mouse, involving duplication or triplication of the first digit, with or without involvement of the metatarsals, appears to be inherited by a single mendelian recessive factor with a penetrance of 60%. There is a second factor, also recessive, which increases the penetrance of the system to 80%. This hypothesis is born out in both the high line and low line anophthalmics (HL-ZRDCT-An and LL-ZRDCT-An), and successive backcrosses of HL-ZRDCT-An x C57 Black/10 to HL-ZRDCT-An.

Of the polydactylous individuals 84% have only the right foot affected, 6% only the left and 10% are polydactylous on both hind feet. In this respect the abnormality resembles that reported by Chase (Genetics, 36:697, 1951) but in its pattern of inheritance it resembles the polydactyly reported by Holt (Ann. Eugenics, 12:220, 1945). There appears to be an association of this polydactyly with anophthalmia (Beck, in manuscript, 1961), but whether this is merely a physiological association such as that reported between polydactyly and *myelencephalic blebs* (Bonnevie, J. Exp. Zool., 67:443, 1934), or polydactyly and *fidget* (Grüneberg, J. Genetics, 45:22, 1943), or whether it is a case of actual genetic linkage has not yet been determined. (Supported by grant BF-10,004 (C1) from the U.S.P.H.S.)

184

SIDNEY L. BECK, Mammalian Genetics Center, University of Michigan. Genetic contribution to the eyeless phenotype.

The anophthalmic mutant of the mouse, first described by Chase (Genetics, 27:239, 1942) and Chase and Chase (J. Morph., 68:279, 1941), now appears to be expressed as the result of interactions between a single recessive factor (ey), two discrete sets of modifiers and various nonhereditary factors. There may also be an additional modifier transmitted only by the male parent. The high line anophthalmics (HL-ZRDCT-An) produce 90% eyeless and 10% intermediate-eyed progeny. Selection for a low line (LL-ZRDCT-An) resulted, after four generations of selection with inbreeding, in the production of 5% eyeless and 95% intermediate-eyed individuals, several being effectively normal-eyed. This reveals the presence of a set of "suppressors" of *ey* small in number and exerting large effects. Four successive backcross generations of normal-eyed *HL-ZRDCT-An* x *C57 Black/10* hybrids to *HL-ZRDCT-An* produced 21%, 29%, 32% and 36% eyeless progeny, respectively. These data indicate the presence of a set of "enhancers" of *ey*, large in number and with small effects. Another "enhancer", transmitted only by the male parent, is suggested by differences in reciprocal backcrosses and by an analysis of variance. High line males crossed with hybrid females produce more eyeless progeny than in the reciprocal cross; an analysis of variance indicates a "sire effect" and no "dam effect" in the *HL-ZRDCT-An*.

Additional pleiotropisms of *ey* are cataract or corneal opacities, seen in most of the intermediate eyes, and a breakdown of maternal behavior, demonstrated by the numerous females which do not nurse their litters. This latter phenomenon is not seen in the normal-eyed control line (ZRDCT-N). (Supported in part by grant BF-10,004 (C1) from the U.S.P.H.S.)

134

DON A. BELDEN, JR. and MYRON P. SMITH, University of Denver. A film illustrating surgical procedures for using the rat in mammalian physiology classes. (30 min.)

Initially, the film illustrates tracheal, carotid and

femoral cannulation step by step. This is followed by a demonstration of direct blood pressure determination using a simplified double rubber membrane tambour in conjunction with a mercury manometer. The effects of various factors on blood pressure are illustrated.

Throughout the film, simplified procedures and modifications of existing equipment are emphasized.

164

NANCY ROSE BENALLY and MARVIN L. RIEDESEL, University of New Mexico. Metabolic rate and body weight of *Dipodomys* deprived of water. (15 min.)

Daily metabolic rate and body weight measurements were made for five consecutive days in six series of experiments on ten *D. ordi* and four *D. merriami*. A series on each species included: 1) animals provided tap drinking water, 2) animals provided sea water for drinking *ad libitum* and 3) animals deprived of drinking water. "Resting" metabolic rates were measured at 23°C and 30°C after the animal has rested in the metabolic chamber for an hour. The "resting" metabolic rate expressed as ml O_2/hr/gm body weight was independent of the type or availability of drinking water. Several authors have suggested that dehydrated kangaroo rats increase body water by increasing metabolic rate. The present study supports the suggestion that the increased metabolic rate is due to increased activity and not a result of changes in the endocrine, biochemical or other factors.

Animals housed in sand-floored cages and provided mixed small grains and drinking water maintained body weight for several months. Kangaroo rats kept in the same environment lost weight under each of the following conditions: 1) when kept in small wire-bottom cages, 2) when deprived of drinking water and 3) when provided sea water. (This study was supported in part by N.S.F. grant G-14495.)

185

MIRIAM F. BENNETT and MAX RENNER, Sweet Briar College and Zoologisches Institut der Universität München. Variations in the collecting activity of honey bees under laboratory conditions.

Collecting visits of workers of a colony of honey bees maintained in a bee laboratory similar to that described earlier (M. Renner, Naturwiss., 42:539, 1955) were recorded automatically as the bees collected a two-molar sucrose solution from an aluminum chamber. During the first recording period of 40 days (Period A), the temperature of the laboratory was constant at 27°C, the relative humidity fluctuated non-rhythmically between 48% and 52% and light intensity was constant at approximately 1000 lux. During the second recording period of 30 days (Period B), conditions were the same except that during three short-term periods, twelve hours of darkness alternated with twelve hours of light. During both periods, the bees were essentially undisturbed.

The average level of collecting activity during Period A was 56.4 bee visits to the collecting chamber/30-minute period. The minimum was zero and the maximum was 147.5 visits/30-minute period. The average volume of solution collected was 1.25 cc/30-minute period. For Period B, the average activity was 34.75 visits/30-minute period with a range from zero to a maximum of 151.0 visits/30 minutes. An average 1.10 cc of sugar solution was collected per 30-minute period.

In addition, collecting activity varied cyclically under constant conditions. The period of the cycle approached 24 hours while its form was a simple one characterized by a peak of activity which occurred roughly twelve hours before and about twelve hours after major minima. Temporal correlations between phases of the activity cycle and hours of the solar day did change. Interestingly, these relationships did not always change gradually. In many cases, the manner of change can best be described as saltatory. Alternating periods of darkness and light (12L:12D) did set phases of the activity cycle relative to those of solar day, and these relationships were maintained for five to six days following the resumption of constant light conditions.

(The investigation was carried out while the senior author held a National Science Foundation Fellowship, 61048.)

26

IRWIN S. BERNSTEIN and WILLIAM A. MASON, Yerkes Laboratories of Primate Biology, Inc. Aggression in a rhesus monkey group. (15 min.)

Eleven rhesus monkeys of both sexes, weighing 5 to 33 lbs were observed systematically over a 75-day period while together in a 24 ft by 48 ft by 8 ft compound and a record was obtained of aggressive behavior and related activities.

Even before the emergence of a stable social hierarchy, aggressive incidents were brief and characteristically unidirectional, consisting of threat or aggression from one animal followed by flight or submission from the other. The incidence of aggression decreased rapidly during the course of the research and there was a corresponding increase in coordinated social activities. Special procedures introduced to enchance competitive interaction became progressively less effective in eliciting aggressive episodes and direct attacks tended to give way to "token" responses. The character of submissive responses also changed with time.

Intragroup conflicts were frequently terminated by the intervention of the dominant male, less frequently by the intervention of other adults and never by the intervention of juvenile animals. In a few instances the intervention of other adults served to disrupt an attack by the dominant male.

The overall decrease in the frequency and intensity of aggressive activities can be attributed in part to the fact that subordinate monkeys tended to maintain a definite distance between themselves and animals of higher rank. It was also noted, however, that the higher ranking animals became more tolerant of subordinate animals in proximity to them. (I.S.B. supported by an N.I.H. postdoctoral fellowship. Additional support was provided by Grant H-5691 and Grant M-4100 from the N.I.H.)

88

MARGARET ANN BERRY, Indiana University. Separation, analysis and bio-assay of embryonic growth substances contained in yolk-albumen of the hen's egg. (Introduced by T. W. Torrey) (15 min.)

Yolk-albumen of the unincubated hen's egg was fractionated by mechanical and chemical means in

an effort to separate and identify substances which are adequate for the support of growth and differentiation of eye primordia of the chick *in vitro*. The various fractions were added to a basal glucose-saline-agar medium for tissue culture by the petri plate method. Eye primordia were obtained from donor embryos ranging in age from primitive streak to 24 somites. All fractions obtained were analyzed for nitrogen content. Further separation and identification of growth substances were effected by chromatographic and electrophoretic methods. The adequacy of all fractions obtained is compared to that exhibited by the full yolk-albumen reported earlier (Harrison, J. Exp. Zool., 1954; Harrison and Berry, Physiol. Zool., 1959). The essential growth substances contained in the yolk-albumen appear to be of both large and small molecular size, are water and alcohol soluble, and are chloroform insoluble. The results of this study are discussed in light of results reported earlier on fractionation of yolk-albumen and embryo extracts.

186

WESLEY J. BIRGE, University of Illinois. Choroid plexus development in the chick embryo.

In this investigation, the right presumptive metencephalic alar plate was ablated by micro-electrocoagulation in chick embryos of 33-38 hours of development. The embryos were subsequently sacrificed at 8-18 days of incubation and histological studies were made on the metencephalic wound area in each instance.

During postoperative development there is no migration of mantle or marginal layer tissue elements into the lesion area, though the intact alar plate undergoes a compensatory hyperplasia starting on the 9th day. However, a simple epithelial membrane closes the lesion opening by the 10th day of development. This epithelium regenerates from presumptive ependymal cells of the intact metencephalic ependymal zone which borders the lesion area.

The developmental fate of this epithelium constitutes the principal point of concern in this study. The constituent cells of this reconstituted epithelium, though derived from presumptive ependymal spongioblasts, do not display the distinguishing characteristics of typical ependymal cells. Rather, they are indistinguishable in appearance from the cells which constitute the choroidal epithelium of the roof of the 4th ventricle. It is evident, therefore, that under certain conditions presumptive metencephalic ependymal cells are capable of following an alternative course of differentiation.

During later development this regenerated epithelium commonly differentiates into choroid plexus tissue. This occurs, however, only when leptomeningeal tissue forms in close association with the epithelial membrane. Retardation of leptomeningeal development results in a concomitant retardation in the differentiation of plexus tissue. The resultant data indicate that the differentiation of choroid plexus tissue is dependent on some causative interaction between the choroidal epithelium and leptomeningeal elements.

89

UNABELLE BOGGS BLACKWOOD, Ohio State University. Changing teratogenic effect of 2-ethyl-5-methylbenzimidazole in the early chick embryo. (15 min.)

2-Ethyl-5-methylbenzimidazole (EMB) at 0.4 and 1.0 mg per egg was injected into the albumen at 20 different intervals from 0 to 70 hours of incubation. Embryos were examined grossly with a stereoscopic microscope at 3 to 6 days of incubation. Each treatment involved 9 to 30 embryos. The data from these studies show that the teratogenic response of the chick embryo to EMB is limited to approximately the first 2½ days of incubation, being markedly reduced by 55 hours and absent by 70 hours of incubation. The changing teratogenic, varying with the time at which treatment was initiated, follows to a great extent the cephalo-caudal pattern of development characteristic of normal embryogenesis. That is, the optimum period for producing malformations of the head precedes that of the heart which in turn precedes that of the trunk. The major shift from a predominance of head malformations to trunk malformations occurs during the formation of the definitive primitive streak. Although it was not conclusively demonstrated, these results suggest that EMB indiscriminately inhibits or alters either induction and/or an early phase of differentiation. It would seem obvious, therefore, that the biochemical processes which EMB interrupts are necessary for induction or beginning differentiation. Considerable evidence by other workers suggests that benzimidazoles inhibit ribonucleic acid synthesis. (Supported by grant RG-7108 from the U.S.P.H.S.)

157

BEN B. BLIVAISS, RUSSELL O. HANSON and H. KUTUZOV, Chicago Medical School. Effect of ICSH on Leydig cells of testes in strain A mice. (15 min.)

Starting at one month of age, 27 strain A male mice were injected daily with 0.15 U. of sheep pituitary ICSH and continued for 25 weeks at increasing dosages to 20 U. per day.

In three testes, Leydig cells (L.C.) appeared atrophic with small, hypochromic nuclei. In 23 testes, L.C. were hypertrophied and had a high concentration of ceroid in the cytoplasm. Nuclei were enlarged and hypochromic. In testes of 14 animals, L.C. were hyperplastic, consisting of large and small cells with pycnotic or crenated nuclei. Small L.C. nodules were found in 12 animals killed from 14-43 weeks after end of treatment. In 3 animals, well defined L.C. nodules occupied an area equivalent to 2 or 3 tubule cross-sections. These consisted mainly of small cells with crenated or pycnotic nuclei.

Strain A male mice, which had been treated with 20 mcg estradiol benzoate in oil per week since one month of age, were also treated daily for up to two months with 0.4-1.25 U. sheep pituitary ICSH starting at 6 months of age.

During the first month, the incidence of L.C. nodules was slightly greater (14%) compared to about 7% in those continuing to receive only estradiol. Thereafter the incidence of nodules and tumors increased in the latter while only diffuse hyperplasia was seen in the former. It appears that exogenous ICSH may induce L.C. nodule formation in normal or estrogen-treated mice, but this effect does not persist, probably because of the antigenic effect of exogenous ICSH. (Supported by U.S.P.H.S. Grant C-1993.)

141

ANN M. BOVBJERG and JERRY J. KOLLROS, State University of Iowa. Development of the

skin glands in the frog, *Rana pipiens*, during treatment with thyroxine. (Introduced by Ray L. Watterson) (15 min.)

During normal metamorphosis, presumptive serous and mucous glands appear in the plical epidermis as solid nests of cells. Serous nests differentiate into hollow, subepidermal glands before any mucous nests do. Serous ducts originate as solid groups of epidermal cells above hollow glands, and later become hollow. Mucous ducts, in contrast, are continuous with and form as outpocketings of hollow glands. Thyroxine treatment of normal and hypophysectomized larvae favors earlier differentiation of mucous glands. The greatest discrepancy in sequence occurs in very young larvae treated at high concentrations (1:50,000,000). Serous nests are rarely seen; mucous glands appear as solid nests and as hollow glands, some of which have ducts. Development is more normal in tadpoles initially treated at older stages, or kept for a longer time at lower concentrations. In these animals, most serous ducts are still solid; most mucous ducts are hollow. However, a few hollow ducts of both types appear to be closed at each end; apparently they hollowed independently of the glands. Tadpoles treated for a long time with very low concentrations of thyroxine or its analogues develop small vesicles in the plical epidermis. These, reminiscent of developing serous ducts, lack any trace of subjacent gland development. These phenomena suggest that 1) sensitivity of the glands to thyroxine is different at each stage; 2) sensitivity of the two gland types is different; 3) sensitivity of the ducts is different from that of the glands. (Supported by grant A-2202 from the U.S.P.H.S.)

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EUGENE C. BOVEE, GREGORY J. BOVEE, DAVID E. WILSON and SAM R. TELFORD, JR., University of Florida. Amebiasis of tissues induced in mice and rats by inoculation with *Acanthamoeba* and *Entamoeba* spp. (15 min.)

Axenic *Acanthamoeba* spp. cause lesions and/or death in mice, but not when injected subcutaneously or intraperitoneally (Culbertson, *et al.*, 1959). These amebas feed on bacteria and cellular detritus (Chang, 1960). Extracts from coliform bacteria, certain amino-acids and ATP facilitate excystment (Singh, *et al.*, 1956, 1958). We inoculted 14-day-old white mice subcutaneously with *Acanthamoeba* spp. and associated coliform bacteria. After 8-18 days trophs and cysts (Lilly strain) were found in coelomic fluid, intestinal lymph nodes, and kidney; in those locales, liver and lung (Hedrick strain); and only in intestinal lymph nodes (Bovee No. 2 strain). One mouse, which died 8 days post-inoculum with the Hedrick strain, had an edema of the lungs, with trophic amebas both there and in a liver abscess. Controls were negative. Cultures of amebas were grown from tissue materials examined and found positive. We also inoculated 8-week-old female white rats with inquilinic *Entamoeba* spp. and *Acanthamoeba* spp. from Florida lizards and snakes. At autopsy, 21-40 days post-inoculum, trophic amebas and/or cysts were found in blood, coelomic fluid, intestinal lymph nodes, liver, spleen, pancreas, kidney, lung and brain of one moribund rat, and in one or more of those locales in each other inoculated rat. Controls were negative. Amebas were cultured from at least one of the infected tissues from each rat, and from all such tissues of the moribund rat. (Supported by grant E-1158 from the U.S.P.H.S. G.J.B., Westwood Jr. High School Science Fair Research Project, Gainesville; S.R.T., Jr., Currently, University of California, Los Angeles.)

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EUGENE C. BOVEE, DAVID E. WILSON and SAM R. TELFORD, JR., University of Florida. Entozoic amebas from feral reptiles.

Examinations were made of both living and fixed and stained amebas from fecal and/or gastrointestinal contents of feral reptiles collected mainly from Florida, but also from other Gulf coastal states, Mexico, Central America, Colombia and Germany. Thirty-four genera and 46 species of reptiles (of 43 genera and 64 species examined) harbored amebas. Morphologically the amebas were distinguishable as of the genera *Entamoeba, Endolimax, Acanthamoeba, Hartmannella* and *Vahlkampfia*. Two associations of amebas were noted which seemed perhaps related to the habitats of the reptiles. In each association a species of *Entamoeba,* one of *Endolimax,* one of *Acanthamoeba* and a small *Vahlkampfia*-like ameba, (perhaps amebo-flagellate?) were present. In snakes and lizards from moist or aquatic habitats or in vagile reptiles the entamoebid species is morphologically identical to *Entamoeba invadens;* the endolimacid species is morphologically identical to *Endolimax clevelandi;* the acanthamebid is indistinguishable from *Acanthamoeba castellani;* and the vahlkampfian species is an unidentified one. The second association, from reptiles which live in xeric, or in well-drained habitats, is composed of an *Entamoeba* sp. distinct from *E. invadens,* an *Endolimax* sp. distinct from *E. clevelandi,* an acanthamebid distinct from *A. castellani* and a small vahlkampfian species closely resembling that of the other association. Whether the reptile which harbors the organism is snake or lizard or of what genus or species did not seem to be determinative so far as the species of amebas present were concerned so much as the habitat occupied by the reptile(s). (Supported by NIH Research Grant E-1158. S.R.T., Jr., currently at the University of California, Los Angeles.)

110

ALAN PRIEST BROCKWAY and HOWARD A. SCHNEIDERMAN, Western Reserve University. The effects of inert gases on the kinetics of gas exchange in the Cecropia silkmoth. (15 min.)

In insects with discontinuous respiration, between bursts, O_2 enters faster than CO_2 leaves. These disparate rates are thought to arise from a mass flow of air into the trachea generated by a small vacuum, the size and duration of which is determined by tracheal pO_2. Previous studies examined the effects on discontinuous respiration of varying external pO_2 and pCO_2 (Biol. Bull. 1960). Here we varied the molecular weight of the inert gas. Pupa were exposed to mixtures of 20% O_2 and 80% of either He, SF_6, or N_2 (*i.e.*air).

The pupal tracheal system was connected to a modified Warburg manometer sensitive to 0.01 mm Hg. The intratracheal pressure cycle consists of (1) a level pressure period: spiracular opening; (2) a pressure fall period: spiracular constriction; and (3) a period of irregular (in frequency, duration and magnitude) pressure falls: spiracular flutter. During fluttering the average duration

of the pressure falls (ADPF) of any pupa was constant for at least a week. In air the ADPF averaged 23.7±1.4 seconds. In $He-O_2$ the ADPF averaged 146.9±7.1% that in air; in SF_6-O_2, 69.0±3.9%. He diffuses out of the trachea faster than N_2, allowing more air to be sucked in; this maintains tracheal pO_2 for a longer period of time above the critical level for spiracular opening. SF_6 diffuses more slowly than N_2, hence less air enters, increasing fluttering. These results show that the "indifferent" component of an atmosphere is not indifferent and may significantly influence gas exchange kinetics. This finding may help explain some physiological consequences observed when animals breathe artificial atmospheres. (Supported by grant H-6320 from the U.S.P.H.S.)

30

JANE VAN ZANDT BROWER and LINCOLN P. BROWER, Amherst College. Further experimental studies of mimicry of honeybees *(Apis mellifera)* by syrphid flies *(Eristalis vinetorum)* with southern toads *(Bufo terrestris)* as predators. (15 min.)

A continuation of experimental studies of mimicry of honeybees by syrphid flies was undertaken with the use of a new design. Forty-four southern toads served as individually caged predators. Because the flies not only look like honeybees, but also buzz in a similar way, the acoustical factor was controlled by deep-freezing the flies so that only visual mimicry was tested. The toads were divided equally into an experimental and a control group. Initially all were given two mimics which they ate. The experimental toads then received a randomized series of five edible insects and five live, intact honeybees. Most of these toads apparently were stung and learned to reject the bees and in a final trial, only 9 out of 22 ate a mimic. The control toads were given the same series of edible insects with de-stung, frozen honeybees which most of them ate. When each was offered a final mimic, 19 out of 22 control toads ate it. The difference in treatment of the final mimic by the two groups of toads is statistically significant ($P<.005$). Since all mimics were dead prior to being given to the toads, it is concluded that syrphid flies are effective visual mimics of honeybees in this experiment. Because de-stung bees were largely eaten by the control toads, it appears that the source of noxiousness of the honeybee to the toad is the sting. The buzzing of both bees and flies no doubt reinforces the visual mimicry in nature. (Supported by grant 8707 from the N.S.F.)

82

LINCOLN P. BROWER, Amherst College, FLORENCE P. CRANSTON, Harvard Medical School and THOMAS E. PLISKE, Amherst College. Further quantitative studies of courtship behavior in the queen butterfly, *Danaus berenice* (Cramer). (Motion picture, 15 min.)

More than 100 two-day old virgin females were released singly to male butterflies in their natural environment in southern Florida and the ensuing behavior quantified. The courtship follows the well known stimulus-response reaction chain. The male pursues the female, overtakes her in the air, and induces her to alight on available herbage by rapidly brushing her anterior with two scent disseminating hairpencils which are extruded from the posterior of his abdomen. If the female is receptive, she acquiesces by folding her wings. The male alights on the female laterally, attempts to copulate, and palpitates her head alternately with his right and left antennae. Copulation occurs, followed by a post-copulatory flight in which the male carries the female to an inconspicuous area where insemination takes place over a several hour period during which both remain stationary. If the female is unreceptive during the ground phase, the male often successfully reinitiates the entire courtship sequence by fluttering above and alighting on her dorsum. Experiments in which females were modified in color and pattern suggested that specific visual stimuli are less important to the males than scent. Dissection of 196 wild caught females of various ages showed that up to 15 inseminations can occur. Twenty single experimental matings indicated a one-to-one correspondence of copulation and insemination. (Supported by grant 8707 from N.S.F. and by a training grant from N.I.H. in cooperation with the Archbold Biological Station.)

117

JAMES CASE, State University of Iowa. Properties of the isolated ventilation regulating center of the cockroach, *Blaberus craniifer.* (15 min.)

The roach neural ventilative control center has been studied in isolated preparations of the ventral nerve cord. The center, which occupies the metathoracic and first abdominal ganglia, continues in isolation to generate neural volleys which a variety of evidence demonstrates are respiratory volleys. The manner of response of the center to CO_2 and electrical stimulation together with the responses of the cord after excision of the center indicate that it produces rhythmic ventilative activity by inhibition of spontaneous, non-rhythmic, CO_2 sensitive activity of respiratory motor units in other ganglia.

Responses of the isolated preparation to a series of weakly dissociated acids and to varied strengths of a bicarbonate buffer system demonstrate that ventilative activity can probably be induced by any sufficiently strong acid in the undissociated state.

38

ERNST CASPARI and HEINZ JOACHIM POHLEY, University of Rochester. Somatic mutations in *Ephestia* induced by purine analogues. (15 min.)

Last instar larvae of *Ephestia kühniella* were injected 8 days after the last molt with 5-10 μl of solutions of 5-bromodeoxyuridine (5 mg/ml) or 2-aminopurine (10 mg/ml), alone or in combination with aminopterin (5 mg/ml). The hind wings of the hatching adults were scored for scales of abnormal shape or pigmentation, each scale representing one cell. On 40 wings of 5BDU-treated animals (20♂,20♀) 104 aberrant scales were found, corresponding to a rate of 4.7×10^{-4}. The rate was increased in animals treated with 5BDU + aminopterin to 8.0×10^{-4}, 49 aberrant scales on 12 wings. In the controls and the animals treated with 2-aminopurine and aminopterin one abnormal scale each was found on 40, 40 viz. 34 wings, corresponding to a rate of about 0.05×10^{-4}. Twenty-four of the aberrant scales induced by 5BDU and 5BDU + aminopterin occurred in clusters of two, indicating that they were derived from the same altered cell by cell division. Out of the total of 153 induced alterations, 76 be-

fonged to a specific phenotype, a rounded scale with pointed tip, the remainder representing a large variety of forms. Since these alterations are induced by 5BDU, an analogue of thymidine, since their rate is increased by aminopterin, an inhibitor of purine synthesis, and since they seem to be transmitted to both daughter cells at mitosis, it is suggested that these alterations represent gene mutations. The implication of this hypothesis for the structure of the genic material in somatic cells will be discussed. (Aided by grant G-13962 of the N.S.F.)

188

ALFRED B. CHAET and MICHAEL S. WEINSTOCK, The American University and the Marine Biological Laboratory. A toxin in the serum of scalded marine fish.

Evidence in support of the toxic factor theory has been obtained while studying the blood or coelomic fluid of various species of scalded animals. Toxins have been reported in a variety of animal phyla including annelids, crustaceans, echinoderms, amphibians and mammals. This report deals with the presence of a toxin in the blood of scalded *Fundulus heteroclitus*, a marine teleost. Fish weighing approximately 7 grams were anesthetized by immersion in 0.1% chlorobutanol sea water for 90 seconds, placed in plastic bags and the posterior half of the animal scalded for 1½ min. at 76° C. In an attempt to accumulate a high titer of potential toxin in the circulatory system of the scalded fish, the *Fundulus* were kept in moist fingerbowls for three hours after scalding until the blood (0.1-0.3 cc/animal) was removed by cardiac puncture. (*Fundulus* will survive in moist fingerbowls for at least 10 hours.) The scalded fish serum was pooled and injected into a series of anesthetized recipient *Fundulus*. All injections were intravascular by injecting 0.2 cc (#30 gauge needle) directly into the ventral aorta. The recipient fish were kept in moist fingerbowls for three hours and then returned to running sea water. Control injections, consisting of serum from anesthetized but non-scalded *Fundulus*, were carried out in an identical manner. Of the 30 recipient *Fundulus* injected with serum from non-scalded fish, 0% succumbed within 96 hours, whereas 51% of the 37 animals receiving injections of serum from scalded fish died within 96 hours (average=9.4 hours). (Supported by grants from the N.S.F. (G-8718, G-15895) and N.I.H. (A-3362).

189

MYUNG MOO CHOE and PETER ABRAMOFF, Marquette University. Relationship of blood volume to absorbed dosage in X-irradiation of the exteriorized circulating blood of rabbits.

It has been indicated that X-irradiation may exert its inhibitory effect on the antibody response by two mutually dependent routes: 1) direct radiation injury to the antibody-producing tissues, and 2) indirect effects of altered homeostasis in the irradiated host. However, no previous studies have indicated whether X-irradiation of exclusively the circulating blood is sufficient to inhibit antibody production. In this study exteriorized blood irradiation has been accomplished by inserting cannulae into the femoral artery of one leg and the femoral vein of the other and allowing blood to circulate via polyethylene tubing connected to a stainless steel chamber having a thin mylar window at the surface of which the irradiation impinges. The irradiation is delivered by a General Electric Maximar 100 X-ray unit for one hour, using no filtration. Since the total volume of blood in different animals varies according to their respective whole body weights, the actual absorbed dosage varies inversely with the total blood volume of the animal. Conventional ferrous sulfate dosimeter solutions representing a fraction of the total blood volume of the animals have been irradiated and a standard curve of blood volume versus absorbed dosage has been plotted. From such a curve the total absorbed dosage can be calculated for animals of any body weight. For example, rabbits weighing 2.5 kilograms when irradiated for one hour at 30KV and 5 m.a. have been shown to absorb 300 r while 3.5 kilogram rabbits absorb 215 r. (Supported by grant AT(11-1)-820 from the U.S.A.E.C.)

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CHARLES CINTRON and DOUGLAS E. KELLY, University of Colorado. An analysis of pineal regeneration in developing newts. (15 min.)

A previous investigation utilizing surgical extirpation of pineal rudiments in embryonic *Taricha torosa* suggested that regenerative potential of this organ may diminish after stages 33-34. The current study was designed to test this possibility.

Discrete pinealectomies were performed on 128 embryos ranging from stage 31 through 40. The animals were allowed to develop for periods of 50, 60 and 70 days after operations, at which times groups were fixed and examined histologically.

Pineal regeneration potential was found to persist through all stages tested. The regenerating vesicles were analyzed from the standpoints of visible differentiation, length, width, cell numbers and mitotic activity. The data obtained indicate that typical normal growth curves take place during regeneration stages. However, comparisons of lengths suggest that early extirpates (e.g. stage 32) approach the end of the exponential growth phases after 50 days, whereas late extirpates (e.g. stage 38) are only beginning exponential phases after the same period. Possible underlying bases for this delay in regenerative activity have been considered.

Mitotic counts tend to support the above conclusion and also indicate that the major regions of proliferation lie in the sub-pineal diencephalic roof, the region of the pineal orifice and, to a lesser extent, within the floor of the regenerating vesicle. Aspects of growth and differentiation at 60 and 70 days, and of control animals, have also been studied and related to a general regeneration pattern. (Supported by N.S.F. research grant G-14423.)

90

RALPH M. CLARK, JR. and HERBERT L. EASTLICK, Washington State University. Results obtained by injecting methylcholanthrene into the yolk sac of the twelve-day chick embryo. (15 min.)

It is well known that methylcholanthrene (MC) is a potent carcinogen when applied externally or internally to various species of juvenile or adult animals but there is little information available on the effects of MC on embryos. Five concentrations of MC, namely, 0.01, 0.1, 1.0, 2.0 and 3.0 per

cent suspensions in sesame oil, were injected into the yolk sacs of twelve-day embryos. Several experiments were carried out in which 0.1, 0.2 and 0.3 ml of each of the above concentrations were injected. Controls were noninjected embryos and embryos injected with 0.1, 0.2 and 0.3 ml of sesame oil.

The results may be summarized as follows: (1) The hatchability of all embryos treated with 0.01% and with 0.10% MC averaged 70%, which is on a par with the hatchability of embryos treated with sesame oil alone, and slightly less than that of untreated embryos. Above these concentrations, the hatchability decreased as the amount of MC injected increased. A hatchability of 41% was obtained with embryos injected with 1.0 mg of MC. Of the embryos treated with 2.0 mg of MC, 33% hatched. With 3.0 mg of MC the hatchability dropped to 17%, and with 4.0 mg the hatchability was 11%. None of the embryos treated with 6.0 mg or 9.0 mg of MC hatched. (2) In the experimental birds, which now range between 10 and 12 months of age, only one tumor, an osteogenic sarcoma, has developed. (3) A dosage of 0.3 cc of 3.0% MC produced necrosis in the livers of the 13- to 18-day embryos, accompanied by a heterophilic response. (This investigation was supported by grants from the Spokane County Cancer Association and grant G-13068 from the N.S.F.)

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M. J. COHEN and D. M. MAYNARD, Bermuda Biological Station, University of Oregon and University of Michigan. Convergence in units of the lobster brain. (15 min.)

Intracellular recordings were obtained from single neurons in the perfused brain of the spiny lobster, *Panulirus argus*. Bundles of afferent fibers dissected from the antennular nerves could be stimulated independently, so analyses of interaction of various pairs of homolateral and heterolateral input were possible.

Most elements were activated by more than one input. In some, the response was essentially alike for several inputs. In many units, however, the responses evoked by different bundles of the antennular nerves appeared to be qualitatively distinct. Such responses included: 1) Homolateral excitation, heterolateral inhibition. 2) Short latency, brief discharges of one or two spikes with one input but long latency, single spikes with a second input. The long latency response augments with repetitive stimulation, while the short latency response often defacilitates. 3) Short latency, brief discharges of one or two large, all-or-none spikes with one input, but longer latency, repetitive discharges of small, all-or-none spikes with a second input. The smaller spikes may in turn evoke the large spikes, suggesting at least two independent spike-initiating regions in the arborizing processes. These observations support the idea that morphological specificity of afferent input may be converted in the central ganglia to characteristic temporal patterns of discharge of the integrating neurons.

Simultaneous or spaced stimulation of two inputs provided clear evidence of spatial summation of subthreshold synaptic potentials, but heterogeneous facilitation was not observed and temporal facilitation was rare. (Supported by U.S.P.H.S. grants B-3271 and B-1624 and grant-in-aid to M.J.C. from the Bermuda Biological Station.)

190

NATALIE S. COHEN and ALBERT S. GORDON, New York University. Studies on humoral regulation of eosinophil release and production.

The plasma of rats subjected to repeated leucocytapheresis has been demonstrated to contain a leucocytosis-inducing factor (Gordon *et al.*, Acta Haematol., 23:323, 1960). In an attempt to develop a more specific eosinophilia-inducing factor, a method has been devised for the removal of large numbers of eosinophils from the rat peritoneal cavity. An adaptation of the technique of Speirs and Wenck (Proc. Soc. Exp. Biol. Med., 88:89, 1955) was employed in male Long-Evans rats (210-260 gm), utilizing intraperitoneally-injected asbestos as an eosinotactic substance. Precautions were taken to maintain pyrogen-free conditions in all treatments of the peritoneal cavity.

As many as 134×10^6 eosinophils could be removed from the peritoneal cavities of the rats within 5 days. This is approximately 45 times the number of eosinophils in the circulation of these animals at any one time. However, plasma of rats subjected to this intense eosinophil withdrawal, when injected subcutaneously as a single dose of 10 ml, failed to affect the eosinophil counts of 150-160 gm male rats.

Large quantities of eosinophils may be easily collected by this technique from the peritoneal cavity and utilized for physiological studies. Among future investigations being considered are: the peripheral and bone marrow eosinophil responses of normal animals injected with eosinophil extracts and the preparation and effects of administration of anti-eosinophil sera. (N.S.C., Predoctoral fellow of N.S.F.; A.S.G. supported by U.S.P.H.S. Grant H-3357.)

53

N. E. COLLIAS, University of California, Los Angeles. A spectrographic study of the vocalizations of the Village Weaverbird, *Textor cucullatus*. (15 min.)

This species has at least 15 characteristic calls, each used in different situations. Some calls are of a general type, resembling those of many other birds, such as "hunger-distress" calls and "pleasure" notes of the young, alarm cries of various intensities and intraspecific threat sounds. There is also a whole series of specialized calls used by the male in relation to the complex nesting habits of the species.

As in other birds the hunger-distress cries and alarm cries often emphasize relatively high and descending frequencies and are often more or less strident. Pleasure notes are very brief, soft, and relatively low-pitched; the same is true of the repetitive calls given when bringing nest materials and the whirring pre-copulatory call. The call by the males announcing arrival of a female is high-pitched with a marked upswing in pitch of each call. The song is most often used in territorial defense, has a very complex structure, and may incorporate various other calls of the species. The most characteristic component of the song is a terminal buzz, which like the threat sound is a relatively low-pitched and prolonged note. It differs from the threat sound in being pulsated and somewhat harmonious. (Supported by N.S.F. Grant G-9741 and U.C.L.A. Grant 1623.)

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JOHN D. COSTLOW, JR., Duke Marine Laboratory, Duke University. Regeneration in larvae of *Callinectes*. (15 min.)

Studies have been made on reared larvae of *Callinectes sapidus* to determine when the capacity for autotomy and regeneration develop. Of particular interest were: the time required for regeneration, how regeneration is affected by larval ecdysis, and possible interaction between the mechanisms associated with ecdysis and with regeneration.

At daily intervals following the final zoeal molt 20 megalops were induced to autotomize one chela. They were then maintained individually under controlled laboratory conditions until the third or fourth crab molt.

Time for development from the megalops to the first crab varied from 5 to 10 days. There was no indication that autotomy or regeneration interfered with metamorphosis. If the chela were autotomized prior to the third day, a large percentage of the megalops displayed the regenerated appendage at metamorphosis. Approximately 50% of the megalops from which chela were removed on the 3rd day regenerated the claw. If autotomized after the third day the chela was usually not regenerated until the second crab stage. If the chela were cut, it was rarely regenerated and mortality was considerably higher.

The hypothesis is presented that the mechanism for regeneration is capable of action during a limited period following molting. After this period regeneration must await completion of metamorphosis. It would also appear that the mechanisms for regeneration and for molting are discrete: *i.e.*, once the pattern of molting frequency and metamorphosis has been established by the larval endocrine system(s), activation of the mechanisms responsible for regeneration does not interfere with molting or increase the time required for metamorphosis. (These studies were aided by a contract 104-194 between the O.N.R. and Duke University.)

191

JOHN D. COSTLOW, JR. and MURIEL I. SANDEEN, Duke Marine Laboratory and Duke University. The appearance of chromatophorotropic activity in the developing crab, *Sesarma reticulatum*.

The black-chromatophore-dispersing activity of eyestalk extracts of successive stages of crab larvae raised in the laboratory as well as of extracts of whole eggs soon after laying to the time of hatching were studied. Eyestalkless fiddler crabs, *Uca pugilator*, were used as test animals. The eggs of *Sesarma* were studied through 18 days of development and the larval stages through 18 days. Most experiments were run in triplicate, using a total of 15 larvae or 15 eggs. Each extract was injected into a group of eyestalkless *Uca* and the response of the black chromatophores was followed for two hours. Total activity values for all extracts in comparable concentrations were determined. Significant chromatophorotropic activity, values of 2.2, 5.8 and 2.8, was obtained from the whole extracts of eggs on the 11th day of development at 25°C. The activity increased gradually until at the time of hatching the values were 15.7, 13.9, 15.0 and 14.6. Through nine days as zoea, values ranging from 10.0 to 17.4 were found. An apparent new level was obtained in the megalops larvae with values ranging from 17.2 to 21.4 through 8 days of development. The values for the first crab fell within the range of the megalops, 16.6 to 21.6. When extracts of eyestalks of newly collected *Sesarma* were compared with those of the 1st crab, the adult values were found to be approximately 3 times greater. (Supported by grants 104-194 from the O.N.R. and B-2324 from the U.S.P.H.S.)

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S. J. COUNCE and D. F. POULSON, Yale University. The developmental effects of hereditary infections in *Drosophila*. (15 min.)

In a number of species of *Drosophila*, the maternally transmitted condition known as "Sex-ratio" (SR) is completely correlated with the presence of treponema-like spirochetes. Moreover, heritable SR conditions can be established in normal females of the same or different species following injection of tissues or extracts containing the infectious SR spirochetes. The characteristics and persistence of any specific SR conditions appear to depend primarily on interactions between the genotype of the host and of the SR spirochete (*e.g.*, Poulson and Sakaguchi, Science 133:1489, 1961).

Absence of males among the adult offspring of SR females is the result of death of most or all XY individuals during embryogenesis. Detailed study of the disturbances in embryos from SR females of *D. willistoni* shows that the stage to which development proceeds is dependent on genotype. In certain genetic backgrounds (highly susceptible) early processes are upset, while in other backgrounds (resistant) development proceeds much farther. There is considerable evidence to suggest that the primary effects involve chromosomes of actively dividing nuclei.

Comparative studies on developmental effects of SR spirochetes in original species and in other species to which they have been artificially transferred are underway. The present report deals with developmental effects of SR in *D. willistoni*, of *willistoni*-SR transferred to various strains of *D. melanogaster*, and *nebulosa*-SR transferred to *D. melanogaster*. The findings will be discussed in relation to genetic diversity of SR agents from different species, the role of host genotype in expression of SR effects, and differential effects of SR agents on development of males and females. Genetic studies on *melanogaster*-SR lines which bear on the last point will be dealt with briefly. (Supported by N.S.F. Grants G-6017 and G-14747 to D. F. Poulson.)

192

V. J. CRISTOFALO and R. R. RONKIN, University of Delaware. Respiration and motility in *Chlamydomonas*.

Some respiratory characteristics of a normal strain of *Chlamydomonas moewusii* were compared with those of a mutant strain of this organism which is flagellated like the wild type, but which is immotile ("paralyzed") under all conditions tested.

Respiration was measured in the dark in 0.04 M phosphate buffer at a pH of 7.2 which was found to be optimum. The QO_2 (dry wt.) of the "paralyzed" strain was 15.2 while that of the wild type was 16.4. RQ values for the normal and paralyzed strain were 0.71 and 0.77, respec-

tively. Sodium cyanide (0.1 M) inhibited the respiration of both strains by 80-90% and completely inhibited motility. Millimolar NaCN inhibited respiration by 50-60% for both strains and reduced the number of swimming cells to 40% of the control group. Diethyldithiocarbamate had virtually no effect on the respiration of either strain or on the motility of the wild type at millimolar concentrations. At 0.1 M, however, this reagent inhibited respiration by 70% in both strains and completely inhibited motility.

Despite the sensitivity of the motility of this organism to reagents which inhibit aerobic respiration, the wild type organisms were found to swim for up to two hours after being placed in a chamber made anaerobic with alkaline pyrogallol. Under aerobic conditions and in the presence of sodium arsenate (6×10^{-2}M) motility was completely and reversibly inhibited.

High concentrations of 2, 4-dinitrophenol were very effective in inhibiting motility. At a concentration of 3×10^{-3}M all motility had ceased while respiration was inhibited 60% in both strains. No stimulation of respiration was noted between 6×10^{-3}M and 1×10^{-7}M.

These data show that there are no differences in the respiratory characteristics tested for these two strains. They also suggest that 50% or more of the aerobic respiration is mediated by a metal oxidase system and that the energy for motility is probably generated by aerobic metabolism, although anaerobic processes may be involved. (Supported by N-onr 1506(00) and N.S.F. Fellowship.)

29

BENJAMIN DANE, Cornell University. (Currently, New York University Medical Center.) A quantitative analysis of the display of the Goldeneye, *Bucephala clangula* (L.). (Introduced by W. G. Van der Kloot) (15 min.)

The display actions of the Goldeneye duck were catalogued by studying 22,000 feet of motion picture film. The filmed behavior was then analyzed to see: 1) whether individual birds performed their actions in a predictable sequence and 2) whether the actions of one bird elicited a specific response by another bird.

The results show that the sequence of actions given by any one bird is not fixed, except that two actions may be "paired" more frequently than expected by chance. Furthermore, there is no evidence that a movement by one bird elicits a specific response from another bird. During precopulatory display, for example, the female is always in one position, while the male performs eight actions in an unordered sequence. The exception to these rules is that the birds perform a set sequence of actions just after copulation.

The evolutionary implications of an unordered sequence of display actions will be discussed. (Supported, in part, by Grant M-2172 from the U.S.P.H.S.)

135

JOSEPH C. DANIEL, JR., University of Colorado Medical Center. Reconstitution of rabbit blastocysts from fragments *in vitro*. (Motion picture, 15 min.)

Blastocysts, flushed from rabbit uteri on the fifth day post coitus, were fragmented with fine forceps. Each piece, when retained in proper supporting media at 37° C, reorganizes itself into a new "blastocyst" within 24 hours. As many as eight separate reconstituted spheres (hereafter called exblastocysts) may be obtained from one blastocyst. Exblastocysts in turn, when ruptured, will again reorganize to secondary exblastocysts. The rupturing-reconstitution sequence may be repeated several times but, so far, not indefinitely, since ultimately badly distorted masses of cells result.

Sections through some exblastocysts show the presence of an inner cell mass and a trophoblast wall of several cell layers in thickness, a condition virtually indistinguishable from normal blastocysts.

The process of reconstitution involves the accumulation of fluid inside of the cellular mass, for the retention of which a remarkable capacity for cellular adhesion is demanded. The calcium and magnesium requirements for blastocyst reconstitution were studied.

Results show that calcium ions, but not magnesium, are essential for this process. Calcium effects reconstitutions in concentrations ranging from 0.2mM to 20mM. Magnesium alone in these concentrations is inert. Higher magnesium concentrations, 2mM to 10mM, permit a slight swelling of the cellular mass but no complete exblastulation. Media partially deficient in calcium cannot be restored to competence by magnesium supplementation.

The cells appear able to store some calcium so that when retained in a calcium-free medium they may initiate abortive reconstitution which collapses within about six hours. Addition of calcium to such depleted media restores the reconstituting process. (Contribution No. 180 from the Department of Biophysics, Florence R. Sabin Laboratories, University of Colorado Medical Center. The work reported here was supported by grant DRG-337E from the Damon Runyon Memorial Fund for Cancer Research.)

169

ROBERT L. DeHAAN, Department of Embryology, Carnegie Institution of Washington. Time-lapse photographic analysis of migration of the precardiac mesoderm in the early chick embryo. (15 min.)

Chick embryos were explanted at early primitive streak stages on their vitelline membranes, with ventral surface uppermost, to the surface of a solidified agar-albumin medium, and submerged in a shallow pool of light mineral oil. They were cultivated for 12-18 hours on a heated microscope stage in an atmosphere of 5% CO_2 — 95% O_2, during which period time-lapse photographs were taken at intervals of 5 frames per minute.

Analysis of these films has yielded the following information. From the early head-process stage on, the paired heart-forming regions can be visualized as areas of thickened mesoderm, composed primarily of numerous discrete clusters of cells. These precardiac cell clusters are actively motile and usually retain their identity throughout early cardiogenesis. Thus, frequently, a given cell cluster can be "tracked" on film during its entire migration from a position in the heart-forming region at Hamburger-Hamilton stage 5, until it is lost in the forming tubular heart at stage 9-10. It has proved possible to track 20 or more clusters in a single heart-forming region.

Representative migration patterns of such clusters will be described. Two conclusions have emerged: 1) The migratory route of a cluster

and its point of entry into the heart are only in part a function of its initial position in the heart-forming region. Influences occurring during the migratory period also affect the fate of a cluster. 2) The heart-forming regions at stage 5 contain some mesoderm which contributes to noncardiac structures.

Some possible mechanisms of the orientation and guidance of these movements will be discussed.

193

ROGER DEROOS, University of California, Berkeley, and University of Missouri. *In vitro* corticoid production by the adrenal of the brown towhee, *Pipilo fuscus*.

Previous investigation of the *in vitro* adrenal secretory pattern of four avian species representing different taxonomic orders revealed corticosterone to be the major secretory product (deRoos, Anat. Rec., 138:334, 1960; Ph.D. thesis, Zoology, Univ. Calif., 1961). Aldosterone was present in smaller amounts. In view of the similarity of the secretory pattern of these species, it was decided to extend these observations to include a member of the Passeriformes, the largest and most diverse avian order.

The adrenal glands from 21 brown towhees, representing 111 mg of tissue, were incubated *in vitro* and the incubation medium extracted as described (*op. cit.*). One unit mammalian ACTH was added per 100 mg of tissue. The extract was chromatographed in the Bush toluene-methanol-water (4:3:1) system (Bush, J. Endocrinol., 9:95, 1953) with authentic standards on a parallel lane. The steroids (located on the developed chromatogram by contact photography) were eluted, and the ultraviolet and sulfuric acid spectra were determined.

Based on these procedures corticosterone was the major steroid produced *in vitro*. Aldosterone was obtained in small amounts. A steroid was present with a mobility slightly greater than authentic cortisone, and this steroid gave a sulfuric acid spectrum identical to the sulfuric acid spectra of the steroid X_1 obtained from the incubation media of the other four avian species. The amounts (μg/100 mg of incubated tissue) of the steroids obtained were: corticosterone 24.0, aldosterone 3.4, and X_1 2.7. (Aided in part by grant G-8805 from N.S.F.)

83

R. H. DENNISTON, University of Wyoming, and PAUL D. MACLEAN, National Institutes of Health. Erection display in male-male and male-female interaction in the squirrel monkey, *Saimiri sciureus*. (Motion picture, 15 min.)

The male squirrel monkey uses display of the erect phallus in a unique way in courtship, and in dominance relationships with members of the same sex (Ploog and MacLean, 1960). In the present study male subjects were exposed in paired encounters to vaginally estrous females and to other males; were placed in a colony of females after one male had been established as its dominant male; were brought into encounter with another male when it had the penis concealed by a loincloth; and were placed in the female group when dressed in a loincloth. Dominance hierarchy was not closely correlated with sexual performance, and, once established, was not significantly affected by concealment of the phallus. Such concealment seemed to lead to increased scores of sexual and dominance behavior in some cases.

49

MILTON DIAMOND, University of Kansas. Permanency of the "protective-effect" of pregnancy toward behavioral and somatic modifications following injected androgen. (Introduced by W. C. Young) (15 min.)

Previous work (Diamond, Anat. Rec., 137:349, 1960) has indicated that female guinea pigs intramuscularly injected with testosterone propionate (T.P.) for an extended period of gestation (day 18 to parturition) do not show the behavior reactions of male-like mounting or the somatic changes of clitoral hypertrophy exhibited by non-pregnant females of the same age and receiving the androgen for a comparable time.

The present study is an attempt 1) to discern if this "protective-effect" of pregnancy is permanent postparturitionally or temporary, lasting only during gestation and 2) to ascertain if lactation has any influence on responsiveness to T.P.

Data from 10 groups of animals have been compiled. The groups consisted of 4 groups of injected and non-injected pregnant and non-pregnant females. Subsequent to parturition, or a comparable period for the non-pregnant animals, each group was subdivided in accordance with a) the administration or the lack of androgen and b) the removal or the leaving of the young and the mother together for nursing.

The results show significantly 1) that the protective effect of pregnancy lasts only during gestation (subsequent to parturition the female guinea pig is as susceptible to behavioral and somatic modification as is any non-pregnant control) and 2) nursing does not significantly affect susceptibility to T.P. (Predoctoral Fellow of the National Academy of Science—National Research Council Committee for Research in Problems of Sex.)

50

HUGH DINGLE, University of Michigan. The role of vision in the orientation of boxelder bugs on causeways. (15 min.)

Boxelder bugs. *Leptocoris trivittatus* (Say) (Hemiptera, Coreidae), when forced to make a turn on a causeway, will usually, if given the opportunity, make a second opposite turn to resume moving in the original direction. I have termed this phenomenon "correcting behavior." Frequency of correcting increases with longer start to forced turn distances and decreases with longer forced turn to choice point distances. Evidence indicates that visual cues are used by the bug to establish a "set"; once the "set" is established, further movements are analyzed with respect to it and, if possible, the "set" is maintained. There are indications of a threshold in the amount of visual information necessary to establish the "set." Once established, it may last for 200 seconds or more.

150

WINIFRED W. DOANE, Yale University. Corpus allatum studies in adult *Drosophila melanogaster* and *Drosophila virilis*. (15 min.)

Although compensatory reduction in size of the host corpus allatum upon implantation of additional corpus allatum-complexes in adult *D. virilis*

was recently verified, this effect could not be demonstrated in *D. melanogaster* (Doane, Science, in press). Experiments designed to determine the nature of this apparent species difference will be discussed. These include: reciprocal transplantation of c.a.-complexes between the two species, determination of the effects of implants on host egg production rates in both species, and variation in the stage of development of host and donor at the time of operation and at sacrifice. The possibility of extraneous factors, such as bacterial infection, producing the effect in *D. virilis* are being considered.

Histophysiological studies of the adult corpus allatum in wild type and various mutants of *D. melanogaster* have been continued. The size and activity of the corpus allatum have been compared in two allelic mutants, one female-sterile and the other fertile, both of which are characterized by hypertrophied fat bodies. (Supported by a Postdoctoral Fellowship under Yale Univ. N.I.H. Training Program in Genetics.)

194

WILLIAM G. DOWNS, JR. and DAVID F. FITZPATRICK, Tennessee Polytechnic Institute. The lymphocyte as a criterion of degree of non-specific stress.

A highly-standardized hybrid strain of albino rats (Tec I) were subjected to insulin injections, ACTH injections, cortisone injections and LD 50/30 exposure to gamma rays. One hundred or more experimental animals were included in each group, and controlled by at least fifty animals which were handled in an identical fashion except for the application of the stress-agent.

Pituitaries, adrenals, spleens, lymph nodes and bone-marrow were all sectioned and studied and all animals had total and differential leucocyte counts done at frequent intervals.

Each group responded in a way consistent with Selye's General Adaptation Syndrome, though there were quantitative and qualitative differences between the animals subjected to the different endocrine injections. However, all of these returned to "normal" within 24-36 hours. The response of irradiated animals was likewise consistent with Selye's findings, though the alarm reaction was much more marked and immediate and subsequent changes continued for weeks rather than hours.

The study included a standardization of methods of analysis which it is believed can be applied to any standardized strain of animals and using any stress-agent.

71a

E. LLOYD DUBRUL, College of Medicine, University of Illinois. Bipedal locomotion: general comments. (10 min.)

It has been demonstrated that there is little structural readjustment for bipedalism in lizards. This differs decidedly from bipedal mammals. The *fact* of bipedalism then, is not a structural common denominator. The *mode* of bipedalism must be crucial.

Amphibians with peculiar bipedalism fortify this notion. Frogs hop effectively by rigorous structural renovation: (1) the tail is eliminated and torso shortened to reduce inertial mass, (2) the leg is lengthened to increase takeoff acceleration, (3) the distal end of the leg is tapered to reduce inertial drag, (4) the head is streamlined.

Non-bipedal mammals are also instructive. Cursorial speed is obtained by: (1) increased flexibility of the vertebral column, (2) increased length of leg, (3) digitigrade foot, (4) massing limb proximally, (5) decreasing limb distally. These are the same features found in bipedal lizards. Speed is the clue.

Man is completely bipedal whether locomoting or not. This required drastic mechanical reorganization. (1) The feet bear weight better with special arches. (2) The legs are bent in the frontal plane to bring the feet directly below the center of gravity. (3) Knees are built to twist and lock in extension. (4) The pelvis is refitted with flared, twisted ilia. (5) The backbone is sinuously bent for torso balance. (6) The thorax is sagittally shortened, broadened, and set back around the central post to decrease its forward moment. (7) The head is distorted—shortened, broadened, bent in base, and domed vertex. The foramen magnum is near the basal center, and jaws and face shrunk, all for better balance atop the vertical central pillar.

36

RICHARD M. EAKIN, University of California, Berkeley. Fine structure of some little known photoreceptors. (15 min.)

The author's recent electron microscopic studies on the reptilian parietal eye and on the amphibian stirnorgan (both published) will be briefly reviewed. The development of the photoreceptoral process in the latter and the fine structure of presumed light-sensitive organs in Amphioxus (both unpublished) will be presented. The receptoral process of the stirnorgan arises as a bulbous outgrowth of an ependymal cell of the epiphysial diverticulum, acquires a fibrillar apparatus like that of a cilium, and differentiates the discs or flattened sacs of the outer segment by multiple infolding of the cell membrane. Each light-sensitive cell (of Hesse) in the neural tube of Amphioxus possesses a labyrinth of tubules on the surface adjacent to the associated melanocyte; cilia-like structures are absent. Thus, Hesse cells do not resemble vertebrate photoreceptors. Ependymal cells in the posterior floor of the cerebral vesicle (infundibular organ?) possess cilia which contain chains of small vesicles and, in addition, long filaments which also have strings of vesicles. These cells may indicate the nature of the evolutionary forerunners of rods and cones in the vertebrate lateral eye. (Supported by grant 14999 from the N.S.F. and by the Miller Institute for Basic Research in Science of the University of California.)

67a

THEODORE H. EATON, JR., University of Kansas. Walking, running and jumping: general comments. (10 min.)

Locomotor adaptations in mammals appear at first sight notably unlike those characterizing the primitive walkers, runners and jumpers among lower tetrapods. But the differences are not fundamental. Anatomically, the evolution of mammalian locomotion required (1) switching the plane of limb movement from the horizontal toward the vertical, (2) an associated change in the position and form of the joints between the girdles and the proximal limb bones, (3) a corresponding shift in the locations and directions of

action of the proximal flexor and extensor muscles of the limbs. Physiologically, the mammals show, in contrast to lower tetrapods, (1) a reduction, but not elimination, of lateral flexion of the trunk in locomotion, and (2) a greater, but still incomplete, dependence of locomotor and postural reflexes on centers in the cerebral cortex and cerebellum. That the primitive neurological pattern of locomotor control associated with swimming and crawling actually forms the basis of locomotion in mammals is suggested by (1) the "crossed-extensor" and "crossed-flexor" reflexes in spinal animals, (2) the production of compensatory movements (or contralateral increase of extensor tone) by stimulation of semicircular canals, (3) the relationship of alternating movements of fore and hind limbs in walking to lateral motions of the trunk. The origin of walking movements in primitive tetrapods seems to have been as an accessory to swimming, in restricted habitats, not as a terrestrial substitute for swimming.

32

HANS ELIAS and PAUL PEVSNER, Chicago Medical School. Architecture of the human pineal gland. (15 min.)

PAPER WITHDRAWN.

156

ALLEN C. ENDERS, Rice University. Further studies concerning implantation in ovariectomized armadillos. (15 min.)

Armadillos bilaterally ovariectomized during the period of delay of implantation retain their blastocysts. Early implantation stages are usually found in such animals approximately three weeks after ovariectomy. Pregnancy proceeds normally for as long as three months. However, there appears to be an increased mortality as pregnancy progresses. When only the ovary containing the corpus luteum is removed during the delay period, recovery of blastocysts is low. However, blastocysts have been recovered from unilaterally ovariectomized animals four weeks and longer after removal of the corpus luteum. No implantation stages or evidence of implantation have been found in these animals. The administration of exogenous progesterone in amounts sufficient to produce an enchanced distribution of glycogen has no effects on the length of time between the operative procedures and implantation in bilaterally ovariectomized animals. Neither has it been possible to produce implantation in unilaterally ovariectomized animals by progesterone administration. The information accumulated thus far suggests an inhibition of the implanation by the ovaries during the delay period, but reveals little information concerning the nature of the inhibition. (Supported by grant G-9113 from the N.S.F.)

84

WILLIAM ETKIN and MILTON DIAMOND, Albert Einstein College of Medicine and University of Kansas. The Japanese monkey center. (Motion picture, 25 min.)

Under the leadership of Prof. Denzaburo Miyadi and Kinji Imanishi the Primate Research Group at Kyoto University has established a center for the study of the Japanese monkey, *Macaca fuscata*. The film to be shown is a teaching film made by this group to illustrate social behavioral studies. We have added English captions. Studies of hierarchy, parental feeding, grooming, play and other behaviors (not all shown in the film) have been facilitated by training the free-ranging animals to come to an open area for feeding (provisioning). Particular interest attaches to the observations by the Japanese workers of cultural transmission. (M.D., Predoctoral Fellow, National Research Council, Committee for Research in Problems of Sex.)

170

D. JoANNE FERRAL, ELLSWORTH C. DOUGHERTY and BURTON BRODY, University of California, Berkeley, and Permanente Medical Group, Oakland. Conditions leading to lysis in axenically grown microannelids of the species *Enchytraeus fragmentosus* Bell, '59. (15 min.)

In both xenic and axenic cultures we have observed a lytic process. In large populations, it is immediately preceded by migration of worms from the agar and their accumulation on the inside wall of the tube. Once begun, lysis extends to all worms within approximately 2-4 days. So far, worm populations of two xenic cultures (in 25-mm O.D. test-tubes, with rolled oats and moistened filter paper as medium) and 12 standard axenic cultures (in 16 mm-O.D. test-tubes, with HLE-Nutrient-Agar medium) have demonstrated a sudden onset of lysis and undergone complete dissolution in a few days' time, with only "ghosts" of the worms left on the glass and agar surfaces. The shortest period in which this has occurred with axenic cultures has been in excess of 55 days from the time at which a culture is instituted with a single fragment (in other words, in about two generations).

Efforts to induce this phenomenon experimentally by adding supernatant from "infected" tubes or by irradiation with from 25,000 to 400,000 rads have thus far failed. Isolated tumorous fragments also lyse, spilling cells and cell aggregates into the medium. (Supported, in part, by N.S.F. Grants G-15034 and G-18122.

171

D. JoANNE FERRAL, ELLSWORTH C. DOUGHERTY and BURTON BRODY, University of California, Berkeley, and Permanente Medical Group, Oakland. Conditions leading to tumor production in axenically grown microannelids of the species *Enchytraeus fragmentosus* Bell, '59. (15 min.)

E. fragmentosus, now in its 10th axenic serial set of cultures, continues to flourish in 1.5 percent Difco Nutrient Agar with 1/16X Heated Liver Extract (=HLE) plus an overlay of HLE diluted to 1/16X with distilled water (Dougherty and Solberg, Nature, in press).

Tumor formation, reported earlier, is regularly observed when worms are subjected to a liquid environment (*i.e.*, when water, HLE, or nutrient broth is added as an overlay to the agar, or when water condenses in the tube). This phenomenon occurs under both xenic and axenic conditions (minimum time: 3 and 5 days, respectively). Tumors first appear at anterior and posterior ends as small protuberances and, if a worm remains in liquid, increase in size, with further growths developing along the body. When, in axenic culture, a newly produced fragment becomes tumorous, further growth is essentially stopped; in some in-

stances one or two tumors become so large that the fragment is dwarfed. The nearer the worm is to maturation the less obviously abnormal does it appear, although fragmentation is inhibited (except in rare instances of division into two). The tumorous process can sometimes be reversed if an afflicted worm is tranferred to standard medium. "Recovery" appears to be a function of the age at which a worm becomes tumorous and of the time thereafter before it is transferred to standard medium. This phenomenon has been studied histologically. (Supported, in part, by N.S.F. Grants G-15034 and G-18122.)

195

MILTON FINGERMAN and R. NAGABHUSHANAM, Newcomb College, Tulane University. Proximal retinal pigment dark-adapting hormone in the eyestack of the dwarf crayfish, *Cambarellus shufeldti.*

The position of the proximal pigment was determined by observing sectioned eyestalks. In these experiments the animals were killed by immersion in boiling water 45-60 minutes after injection of saline or eyestalk extract. Their eyestalks were then removed and placed in Bouin's solution. After being dehydrated and embedded in paraffin, the eyestalks were sectioned at 20μ. With the aid of an ocular micrometer the distances (A) from the cornea to the distal edge of the proximal pigment and (B) from the cornea to the basement membrane were measured. The ratio A/B was called the proximal pigment index. In a fully dark-adapted eye the index was 1.0; all the proximal pigment lay proximal to the basement membrane. The mean index of controls in black containers under an illumination of 29 ft c was 0.73. When crayfish maintained under the same conditions as the controls were injected with eyestalk extract, a dark-adaptational response occurred; the index increased to a mean of 0.88. Controls received physiological saline. The difference between the means was statistically highly significant. Eyestalk extract had caused the proximal pigment to migrate at least one-half the distance from where it was in the controls toward the fully dark-adapted position. The extract concentration was one pair of eyestalks per dose. These extracts had no effect on the proximal pigment of dark-adapted dwarf crayfish, but, as expected, light-adapted the distal pigment. (Supported by grant B-838 from the U.S.P.H.S.)

196

MILTON FINGERMAN, R. NAGABHUSHANAM and LORALEE PHILPOTT, Newcomb College, Tulane University. Evidence for endocrine regulation of the proximal retinal pigment of the prawn, *Palaemonetes vulgaris,* based on alterations in rates of dark-adaptation.

Dark-adapted prawns illuminated five minutes continued their light-adaptational response in darkness for at least 10 minutes before beginning to dark-adapt. In contrast, dark-adapted prawns illuminated 15 minutes did not continue to light-adapt after their return to darkness. In another experiment, one group (A) of prawns was illuminated (30 ft c) all night and the second (B) was in darkness. At 5 A.M. both groups were illuminated (250 ft c) for one minute and then placed in darkness. Group A dark-adapted at about the maximal rate, dark-adaptation being completed in 60 minutes. In contrast, group B had not completely dark-adapted after 300 minutes. The differences between the responses of the respective groups depended upon the amount of illumination prior to returning the prawns to darkness. If the proximal pigment were an independent effector, then its behavior should depend only upon the illumination at any one time and should not be greatly influenced by previous illumination. Rather, the results of these experiments can be explained readily in terms of at least a light-adapting hormone. Continued light-adaptation in darkness could have been due to light-adapting hormone released in a burst soon after the illumination began and which continued to operate for at least 10 minutes whether the prawns were in light or darkness. The inability of group B to dark-adapt could have been due to release of an excessive amount of light-adapting hormone that had accumulated in prawns in darkness but not in light. (Supported by grant B-838 from the U.S.P.H.S.)

197

HELEN FOX and EDWIN A. MIRAND, Roswell Park Memorial Institute, Buffalo. Transmissibility of Friend Virus Disease to offspring by infected mothers.

Friend Virus Disease (FVD) is a neoplastic disease in HA/ICR Swiss mice characterized by hepatosplenomegaly, erythroblastosis, erythrocytosis, hypervolemia, leucocytosis and uncontrolled proliferation of reticulum cells (Mirand *et al.,* 1960, 1961). Recent observations have indicated that female breeders of HA/ICR Swiss strain infected with Friend virus before and after mating with non-infected males can transmit the FVD to offspring, for FVD occurred in 7% of 309 offspring. These infected offspring developed hepatosplenomegaly and manifested typical hematological changes characteristic of the disease. In a few instances, offspring from second litters came down with the disease. The FVD was not transmitted to the male parent. Sixty-six resistant offspring 4-6 weeks of age were challenged with Friend virus (10^{-1}) to determine their susceptibility, and 52% came down with the disease, whereas the percentage in the controls was 88%. Fifty per cent of the resistant male breeders were susceptible to the disease after a similar challenge with the virus.

In conclusion, these studies show that infected mothers can transmit the FVD to 7% of their offspring in spite of conferring to the majority of them a significant degree of immunity. However, this immunity is not permanent for all mice after challenging with Friend virus. Studies are in progress to determine in what manner the Friend virus is transmitted to offspring. (Supported by grants from the U.S. Public Health Service and the Hartford Foundation.)

143

GARY FREEMAN and JANE OVERTON, University of Chicago. Lens regeneration from the cornea in *Xenopus laevis.* (15 min.)

Lenses removed by corneal incision from *Xenopus* larvae (stages 46, 50, and 55; Nieuwkoop and Faber, '56) regenerate consistently. At metamorphosis this capacity for regeneration is lost. Histological analysis of animals sacrificed at various intervals during regeneration shows that the lens develops by an aggregation of cells of the inner layer of the epithelial cornea, which forms

a vesicle that differentiates into the lens. This observation is supported by transplantation studies in which epithelial cornea labeled with tritiated thymidine was transplanted into the eye cup of unlabeled hosts from which the lens and epithelial cornea had been removed. The developing lens contained labeled cells. Consistent results were obtained in experiments in which the host was labeled and graft unlabeled.

When epithelial cornea, or larval epidermis, was grafted over the eye cup after removal of host epithelial cornea and lens, only epithelial cornea was competent to allow for lens formation.

When eye cup and lens were removed, leaving epithelial cornea intact, lens regeneration failed, demonstrating the essential role of the eye cup in lens regeneration. However comparisons in different larval stages of the volume of the eye cup and developing lens at the time when lens fibers are first forming shows that lens fiber synthesis is also dependent on the size of the lens vesicle. (Aided by N.S.F. grant G-8251.)

198

W. L. FRENCH and J. B. KITZMILLER, University of Illinois. Mosquito chromosome preparations using colchicine pre-treatment.

Consistently good preparations of chromosomes in mosquitos may be quickly and easily prepared using pre-treatment with colchicine and a modified mammalian chromosome technique (E. B. Lewis, DIS-34, 1960). Chromosomes have been prepared from the brains of all larval instars (first and fourth instars are best), pre-pupae and pupae, and from testes and ovaries of pupae and adults of *Culex p. pipiens, C. restuans, Anopheles quadrimaculatus, A. punctipennis, A. freeborni* and *A. earlei.* This method results in up to a hundredfold increase of figures per slide as compared with other procedures. The process is as follows: (1) Larvae or pupae are grown for 3-24 hours in a solution of colchicine alkaloid U.S.P. (.1 gram in 100 cc double dist. H_2O). Larvae feed during this time. Adults feed on a solution of .1 gram colchicine in 50 cc distilled water, 50 cc honey. (2) Dissection is in a hypotonic sodium citrate solution (1 gram $Na_3C_6H_5O_7 \cdot 2\ H_2O$ in 100 cc double distilled H_2O) on a silicone treated slide. (3) Fixation in Carnoy's (equal parts 45% glacial acetic acid, 50 cc 85% lactic acid). Stain for 30 seconds to 3 minutes. (5) Spread by placing clean untreated slide on top of coverslip, turn over, hold coverslip tightly in place with filter paper and tap gently. Slide is now ready to examine. It may be ringed for temporary use, but we routinely make permanent preparations using liquid nitrogen.

The advantages of the process are its simplicity, its rapidity, its reliability and the many-fold increase in usable chromosome preparations. (Supported by grant E-3486 from the U.S.P.H.S.)

69

CARL GANS, University of Buffalo. Locomotion without limbs. (25 min.)

The fundamental system for locomotion without limbs involves progression by lateral undulations travelling caudad along the trunk. Propelling forces are exerted laterally and angled to the axis of travel, necessitating at least two contact surfaces to attain steady, non-oscillating, motion. Weight passes vertically through the ventral surface. The method serves when body support does not require major specializations, *i.e.* when travelling in a liquid.

On land the lateral forces must be exerted onto discrete, irregularly placed, objects—implying curvatures of varying radii maintained as they move along the trunk. Also gaps in the substratum must be crossed and the body raised—implying resistance of the vertebral column to vertical deflections. Complex articulations of the vertebrae and subdivision of the muscle masses into individual elements, often linked to span series of segments, reflect this. Certain species have attained extreme ability to form short radius curves by channeling muscles between bony septa. Other forms achieved a ventral shift of the lateral contact level by changing the trunk's cross-sectional shape.

The most important morphological specialization beyond this level has been the uncoupling of the integument from the immediate vertebral segment. Integumentary slippage along the trunk permits "rectilinear locomotion" in which propulsive and supporting forces may pass through the same surfaces.

Other modifications permit anchoring one part of the body while another is extended or retracted. Some species accelerate this into a leap.

In "side-winding," static is substituted for sliding-friction by a behavioral rather than a morphological mechanism. The animals cross slippery surfaces by reducing the load per unit area and by moving at an angle to the contact line between body and substratum.

Several methods may be combined by a single species, often simultaneously along successive sections of the trunk. (Supported by grant G-9054 from N.S.F.)

174

ALLEN H. GATES, L. L. DOYLE and R. W. NOYES, Stanford University School of Medicine. A physiological basis for heterosis in hybrid mouse fetuses. (15 min.)

The growth increments of hybrid and inbred eggs and fetuses developing in mothers of the same strain were compared following the four possible types of matings involving two inbred strains of mice: BALB/c and 129. Just before term, the F_1 hybrid BALB/c X 129 fetuses weighed about 20% more than the inbred BALB/c X BALB/c fetuses. It was also found that near the time of implantation F_1 hybrid BALB/c X 129 eggs had already reached a considerably greater degree of development than inbred BALB/c X BALB/c eggs as determined from counts of nuclei in squash preparations of eggs stained with aceto-orcein. In contrast, neither fetuses nor preimplantation eggs from the 129 X BALB/c cross were appreciably more advanced in development than those from the inbred 129 X 129 mating.

Previous work based on transfers of mouse eggs has demonstrated that overdevelopment of the egg relative to the degree of endometrial development at the time of implantation leads to an increased fetal weight. The present observations suggest that in some inter-strain crosses the greater weight (heterosis) reached by the hybrid mouse fetuses compared to inbred fetuses developing in mothers of the same strain results primarily from a developmental advantage of the implanting egg over the uterus. (Supported by Grants RG-7706 and RG-5450 from the U.S.P.H.S. and G-14355 from

the N.S.F. R.W.N., currently at Vanderbilt University School of Medicine.)

149

LAWRENCE I. GILBERT and WILLIAM S. HERMAN, Northwestern University. The action of juvenile hormone extracts on the prothoracic glands of silkworm pupae (15 min.)

Supernumerary molts can now be routinely produced in pupae of *A. polyphemus* by injection of crude and highly purified concentrates of juvenile hormone. By the study of Feulgen stained whole mounts and hematoxylin stained sections, it has been possible to demonstrate the existence of healthy prothoracic glands in "second pupae" and in "third pupae" as well. These extremely large polymorphonuclear cells are similar in structure to those found in the normal pupa. In all cases, the animals resulting from the supernumerary molt were more adult than the "second pupae" suggesting a breakdown or inactivation of some of the injected hormone. Healthy, active glands were identified in animals after the supernumerary molt indicating the initiation of a second supernumerary molt. Degeneration of the prothoracic glands at the beginning of normal adult development is one reason that most adult insects never molt, and is due in part to the final molt in the absence of juvenile hormone (Wigglesworth, 1955). Our results are the first *direct* evidence that the juvenile hormone can maintain the prothoracic glands, and indicate that they are one of the pupal tissues most sensitive to juvenile hormone. Since highly purified juvenile hormone samples can maintain the prothoracic glands and can also stimulate these glands to secrete (Gilbert and Schneiderman, 1959), the prothoracic glands exemplify an endocrine gland whose structure and secretory function in this case depend on a hormone from another gland. (Supported by grant A-2818 from U.S.P.H.S.)

166

ERWIN GOLDBERG, J. POLAND, R. RENN, C. J. JOHNSON, and C. NORMAN, North Dakota State University and West Virginia University. Susceptibility to stress of aging spermatozoa. (15 min.)

Senescence has been described as the increasing susceptibility of the organism to stress, injury or changes with age. This concept is supported by a number of investigations on whole organisms. Longitudinal studies necessary for quantitative expression of this phenomenon and its relationship to the aging process are made difficult because tissues of the organism are growing and differentiating at different rates, and there is individual variability inherent in the population. Total life span of test animals is also a problem.

Spermatozoa, representing a homogeneous population of cells, were maintained in a chemically-defined medium, making possible the study of the response of aging cells to stress. Temperature change was selected as the stresser. The motility and percentage of live sperm in the suspension were chosen as parameters to assay the effect of exposure to 0°, 5°, 10°, and 15° C, on selected days from 0 through 14, after collection. On day 0, exposure to 0° and 5° C was harmful; 10° C damaged 2-day old cells; exposure to 15° C was not detrimental until day 12. In all cases the amount of damage, when it occurred, increased with cell age.

This study represents a quantitative evaluation of the theory that vulnerability to stress increases with age and further suggests that this hypothesis is applicable on the cellular as well as organismic level. (Supported by grant RG-6339 from the N.I.H. J.P. and R.R., Undergraduate Research Participants of N.S.F., 1961.)

24

GILBERT GOTTLIEB, Dorothea Dix Hospital, Raleigh, North Carolina. The relation of developmental age to auditory and visual imprinting. (15 min.)

Communally reared ducklings (60) and ducklings reared in visual isolation (60) were exposed (training) to a vocalizing, moving model at various developmental ages. Subsequently, the ducklings were exposed to the vocalization *sans* moving model (auditory imprinting test) and to the moving model *sans* vocalization (visual imprinting test). In the isolated ducklings, auditory imprinting was stronger than visual imprinting as a function of training at the youngest developmental ages, while visual imprinting was stronger than auditory imprinting as a function of training at the oldest developmental ages. (This relationship was not evident when the ducklings' performance was cast according to post-hatch age.) In the communally reared ducklings, where rearing did not severely reduce visual experience, visual imprinting was stronger than auditory imprinting at all developmental ages. It was suggested, therefore, that visual experience facilitates the development of the competence for visual imprinting in ground-nesting species. (Supported by a grant from the Division of Research, North Carolina Hospitals Board of Control.)

25

BERNARD GREENBERG, Roosevelt University. Parental behavior and imprinting in cichlid fishes. (15 min.)

The brooding cycles of *Hemichromis bimaculatus* and *Aequidens portalegrensis* are very similar in timing except that the latter have a longer pit young stage. Exchanges of eggs or wrigglers between the two species resulted in ready acceptance of foreign young. Experienced as well as inexperienced pairs raised foreign spawn successfully in alternation with their own or were induced to brood mixed schools. Acceptance of eggs, wrigglers or free-swimming young was limited to those individuals, regardless of species, which matched in age and behavior the parents' brooding phase. Therefore, it is concluded that parent *H. bimaculatus* and *A. portalegrensis* are not imprinted on the species characteristics of their first or subsequent young. Instead, there appears to be an internal mechanism regulating the duration of the phases of parental care, that limits the responsiveness of the parents to particular stages of young. (Supported by grant RG-4957 from the U.S.P.H.S.)

131

MICHAEL J. GREENBERG and DONALD A. WINDSOR, University of Illinois. The responses of bivalve hearts to acetylcholine. (15 min.)

A wide range of acetylcholine concentrations

was tested on the isolated ventricles of nearly forty species of bivalves. The object was to study the depressor and excitor responses of the hearts and the distribution of these responses in the Class Bivalvia.

The hearts were prepared as previously described (Greenberg, Brit J. Pharmacol., 15:365, 1960). It was sometimes necessary to induce beating with 5-hydroxytryptamine.

The depressor effect of acetylcholine is a decrease in the amplitude and frequency of beat and in the tone of the heart. The conspicuousness of any of these three components in a response depends upon dose and species. The concentrations of acetylcholine producing diastolic arrest and threshold response, and also the ratios of these concentrations, varies from preparation to preparation. In a few genera, no depressor action was obtained.

The excitor effect occurs at higher concentrations and is less variable. Excitation begins with an increase in tone superimposed upon the depressor action. Threshold is usually about 3×10^{-6} M. Increases in tone and frequency, resulting in systolic arrest (5×10^{-5}M), are the most outstanding components of the response.

Studies on *Schizothaerus capax* hearts indicate: 1) that the excitor and depressor effects of acetylcholine are independent and 2) that the excitor effects of acetylcholine and epinephrine are related. However, the acetylcholine excitation is probably not produced by a release of stored catechol amine.

Hearts in sixteen of the nineteen families tested were excited by acetylcholine. The excitor effect is probably a general phenomenon masked, where it cannot be demonstrated, by a strong inhibitory response to acetylcholine. (Supported by a grant from the University of Illinois Research Board.)

107

P. W. GREGORY, L. M. JULIAN and W. S. TYLER, University of California, Davis. Comparisons of achondroplastic brachycephalic dwarf segregates from comprest and control stocks. (15 min.)

The mutant comprest, subnormal in size, when mated *inter se* produces a percentage of segregates that are achondroplastic short-headed dwarfs which resemble in size and general morphology the achondroplastic recessive segregates produced by control stocks of "normal" size. This study compares specific anatomical diagnostic characteristics of 65 dwarfs produced from several types of comprest matings with the standard values established for the similar dwarf type produced by control parents of normal size. Achondroplastic short-headed dwarfs from each group exhibit lesions of the wings of the sphenoid and the posterior intra-occipital synchondrosis in essentially the same degrees and percentages. Dwarfs from both groups exhibit the same time of fusion of the spheno-occipital synchondrosis which occurs from birth to 6 months of age. The three metacarpal indices $\frac{\text{total length (TL)}}{\text{diaphysis length (DL)}}$, $\frac{\text{total length (TL)}}{\text{diaphysis diameter (DD)}}$ and $\frac{\text{diaphysis length (DL)}}{\text{diaphysis diameter (DD)}}$ are 1.24 ± 0.016, 4.1 ± 0.29 and 3.3 ± 0.21, respectively, and thus do not differ significantly in any of these values from the short-headed dwarfs produced by control parents of normal size. These similarities strongly indicate that the achondroplastic short-headed dwarf produced by comprest parents is identical biologically and genetically with the achondroplastic short-headed dwarf produced by control parents of normal size. (This study was made under Western Regional Project W-1; it was also supported in part by grants A-5321 and A-2626 from U.S.P.H.S.)

113

G. F. GWILLIAM, Reed College, and JAMES CASE, State University of Iowa. Amino acid sensitivity of the dactyl chemoreceptors of *Carcinides maenas*. (15 min.)

Electrophysiologically demonstrable dactyl chemoreceptors of the first walking legs of *Carcinides maenas* exhibit prolonged bursts of activity in chemosensory fibers in response to aqueous extracts of *Mytilus* soft parts applied to the dactyl tip. The same preparation responds well to 5×10^{-5} M l-glutamic acid in sea water. D-glutamic acid, glycine, glycyl-l-glutamic acid, and l-glutamine are detected at concentrations of $1\text{-}4 \times 10^{-4}$ M, but with much less chemosensory fiber activity. Considerably higher concentrations of a variety of other amino acids and variously substituted glutamic acids are required for stimulation. The preparation also distinguishes the l- and d-isomers of leucine and aspartic acid, exhibiting greater activity in response to d-leucine and l-aspartic than to their antipodes. In a few preparations it was evident that d-glutamic acid activates different fibers than does l-glutamic acid.

The carbohydrates sucrose, lactose, and glycogen are only mildly stimulatory as are relatively high concentrations of methanol, n-propanol, and n-butanol. 0.1 M acetic acid (pH 2.95) is also only mildly stimulatory.

Behavioral observations on blinded *Carcinides* indicates that these chemoreceptors function in orientation of the animal to a food supply. (Supported by grant G-5997 from the N.S.F. and B-1890 from the U.S.P.H.S.)

148

IRVINE R. HAGADORN, University of California, Berkeley. Neurosecretory activity in the brain of a leech, *Theromyzon rude*. (Introduced by Howard A. Bern) (15 min.)

The brain of the rhynchobdellid leech, *Theromyzon rude*, contains three principal tinctorial types of cells: α-cells, which stain with paraldehyde-fuchsin; β-cells, which stain with orange G; and Δ-cells, which stain weakly with paraldehyde-fuchsin. α-cells and β-cells contain cytoplasmic inclusions suggestive of intense glandular activity; Δ-cells show only minimal signs of activity. The secretory cells are found throughout the supra- and sub-esophageal ganglia and also in the segmental ganglia. The acidophilic β-cells may be equivalent to cells showing numerous, enormous, modified mitochondria in the electron microscope.

The α-cells show a distinct yearly cycle of activity. The number of active α-cells and the incidence of axonal transport increase with reproductive activity. From October to February, both α-cell secretory signs and reproductive activity are minimal; both phenomena reach a peak in May-June. This correlation between neurosecretion and reproduction will be presented in detail. The observed parallel between α-cell activity and the reproductive cycle in *Theromyzon*, with increase

and decrease in reproduction following similar changes in activity of the α-cells, suggests that the α-cells may exert an influence on the gonads. This suggestion is supported by the observation that experimental manipulation of the amount of light received daily by the leeches affects both reproductive activity and cytologic characteristics of the α-cells. The standard endocrine experiments of ablation and re-implantation have been undertaken to test whether the leech brain exerts humoral control over the gonads. (N.S.F. Predoctoral Fellow in Biology. Supported in part by grant G-8805 from the N.S.F.)

175

HOWARD L. HAMILTON and C. WARD KISCHER, Iowa State University. Mitochondria and morphogenesis. (15 min.)

Skin from the backs of chick embryos of stages 31-33 was grown for 2-3 days in tissue cultures containing 200 μg/ml of alkaline phosphatase of intestinal origin (Mann; 15,000 units/mg). Feathers developed much more rapidly and attained greater length in treated cultures than in controls. Additions of heat-treated enzyme (80°C for 15 minutes) had no effect.

Sections stained with toluidine blue showed that phosphatase-treated cultures had greater basophiiia not only in morphogenetic regions but also in the epidermis between feathers. Close study revealed that the basophilia was localized in mitochondria. These were situated mainly between the nucleus and the basal edge of each epidermal cell and were conspicuous in phosphatase-treated cultures because of their greater size. The mitochondria of the morphogenetic zone in feathers were long rods with interdigitating cristae extending across their complete diameter (see abstract by Kischer, this issue). They occurred in clusters, often appearing gathered together by their ends. They diminished in length outside the feather area until they became mere dots. Basal cells of the skin epidermis normally had inconspicuous mitochondria and showed little cytoplasmic basophilia. When grown with phosphatase, these cells developed a "shower" of basophilic particles (mitochondria?) between the nucleus and the cytoplasmic boundary next to the dermis.

Treatment with ribonuclease removed all trace of basophilia from the mitochondria. Their stainability by Regaud's dichromate-hematoxylin method was not affected by pre-treatment with ribonuclease. It is tentatively concluded that ribonucleoprotein is not one of the essential structural elements of the mitochondrion, but is a component of mitochondrial activity. (Supported by grant RG-3813 (C8) from the U.S.P.H.S.)

199

ERNEST W. HARTUNG, University of Rhode Island. Studies on the homograft reaction in *Rana pipiens* utilizing C^{14} labeled glycine.

Kidney homografts were made into dorsal lymph sacs of host *Rana pipiens*. Such hosts were then injected intraperitoneally with C^{14} labeled glycine at 15 microcuries per host. One group was injected 24 hours following grafting, the second 48 hours after, the third 72 hours after, etc., up to 28 days. Twenty-four hours following injection, host groups were sacrificed, grafts and normal kidney removed, and fixed. Plugs of uniform diameter sectioned at 50μ from grafts and normal kidney were scored for radioactivity in a windowless flow counter. Preparations of graft and normal tissues were made and studied microscopically. Radioactivity of normal host and graft tissues proved similar in frogs injected one to four days after grafting. In hosts injected days 5 to 12 following grafting, radioactivity of the graft was less than normal host tissue. Groups injected days 13 to 17 showed increasingly similar counts for host and graft. This remained constant to 28 days. Examination of graft and host tissues revealed microscopic similarity without evidence of homograft reaction in grafts up to seven days following implantation. Thereafter invasion by white cells, and other changes became evident. It appears that radioactivity of the graft decreases prior to microscopic evidence of homograft rejection. Question is raised whether graft rejection is initiated by white cell invasion or whether such invasion is a phenomenon evoked in response to a more fundamental physiological rejection featuring reduction in host-graft exchange two or more days earlier. (Supported by Grant C-3253 from the U.S.P.H.S.)

200

ERNEST W. HARTUNG and C. J. LAFLAMME, University of Rhode Island. Homograft studies of the developing limb bud area of tadpoles of *Rana pipiens*.

Previous work by the senior author has demonstrated that large embryonic tissue masses, or organs, and tissue or organs from newly hatched tadpoles of *Rana pipiens* may be successfully transplanted into adults of the same species. This is true up through Shumway stage 25. Beginning at Shumway stage 26, however, heterogeneous tissue masses, or organs from a tadpole donor will be rejected by an adult host in a typical homograft reaction. Since the limb bud has yet to make its appearance at stage 25 and therefore is a system which must, in a sense, still undergo embryonic differentiation during later stages of tadpole development, the question was posed whether isolated limb buds or small cell masses from the limb bud area of tadpoles beyond Shumway stage 26 might still successfully be grafted into adults as were embryonic tissues from younger stages. A number of grafts of varying size taken from limb bud and potential limb bud areas of a series of tadpoles of Shumway stage 26 and beyond were implanted into lymph sacs of adult hosts utilizing techniques which had resulted in successful grafts from younger donors. All such implants were rejected in typical homograft reactions. It was concluded that the development of potential for evoking a homograft response emerges as a systemic phenomenon in the developing tadpole and is not a function of the state or level of differentiation of particular tissues.

67

MILTON HILDEBRAND, University of California, Davis. Walking, running and jumping. (25 min.)

One or more gaits of 30 genera of mammals in 9 orders were analyzed from motion pictures taken mostly at 100 to 200 frames per second. Frame by frame examination enabled the preparation of "progression diagrams" showing the pattern of the support intervals of the limbs in relation to time. Paths followed by the feet in regard to shoulder

and hip, and also in regard to the ground were plotted. These and similar data permit tentative generalization about the relation of gaits to requirements for speed, support, body conformation, body size, and maneuverability. Change of lead and gait, and change of speed without changing basic gait are considered.

A long stride results from long legs having relatively long distal segments, digitigrade or unguligrade foot posture, sagittal position and freedom of rotation for the shoulder blade, and flexion and extension of the back timed to increase reach and achieve a measuring worm motion of the spine. A fast stride results from having muscle insertions that are close to the joints they move and from swinging a maximum number of joints in the same direction at the same time. Economy of effort required by large cursors results in part from reducing the mass of muscles that rotate, abduct, or adduct, by passively restricting motion to the sagittal plane with bone fusions and modifications of joints, and by cushioning impact with suspensory ligaments.

59

ROBERT W. HULL, Northwestern University. Sensitivity of ciliated protozoa to polycyclic hydrocarbon carcinogens. (15 min.)

Utilizing the principle of photodynamic activation introduced by Raab in 1900, a rapid and sensitive test for polycyclic hydrocarbons in high dilution has been developed. The test depends upon the destruction of the normal physiology of ciliate protozoa when they are in the presence of the hydrocarbon and are simultaneously exposed to low intensities of light in the near UV wavelength range. Polycyclic hydrocarbons known to be carcinogenic on the basis of tests on mammals show differential effects from non-carcinogenic hydrocarbons in this assay system.

The test as initially standardized in this laboratory utilizes *Paramecium caudatum* cultured in axenic media or in media containing *Aerobacter aerogenes*. Other ciliates have been tested for possible use in the test in order to achieve maximum sensitivity and minimum variability of the assay system. Preliminary data indicate that holotrichs and heterotrichous spirotrichs are more sensitive than are members of the other major ciliate groups. Variations in sensitivity between tests utilizing different populations from species or from closely related species of ciliates seem to be related to the ciliates' physiological state at the time the test is performed. Ciliate populations showing a high reproductive potential are more sensitive; conversely, individuals in division stages are less sensitive than those exposed to the test system immediately prior to division. Ciliates feeding saprozoically are likewise less sensitive. Enhanced sensitivity appears when the ciliates are starved before exposure to the test situation. Measures designed to quantify these effects and the implications of the variations in response to the test system as regards the basic mechanisms of test phenomenon will be discussed.

115

JOSEPH C. C. HWANG, University of Oregon. The function of a second sensory cell group in the accessory-flexor proprioceptive system of crab limbs. (Introduced by Melvin J. Cohen) (15 min.)

In the walking legs of the crab, *Cancer magister*, a group of approximately 30 large (70μ) and numerous smaller (20μ) sensory neurons send their distal processes into the origin of the accessory-flexor muscle, at the proximal end of the meropodite. The axons run proximally to join the main leg nerve. Distally the tendon of the accessory-flexor muscle inserts on the tendon of the main flexor muscle just as the latter attaches to the carpopodite. Thus the action of the mero-carpopodite (MC) joint indirectly changes the length of the accessory-flexor muscle and in turn alters the discharge patterns of the attached sensory cells.

Electrical recordings from the axons of these sensory neurons show that certain neurons exhibit a phasic response only during joint movement, while others respond exclusively to static positions of the MC joint. Still other neurons show both phasic and static components in their responses. All these sensory cells respond primarily to extension of the MC joint and thus functionally complement the flexion sensitive elastic strand sense cells described by Cohen ('60). Low frequency vibrations up to 100 c.p.s. evoke discharge from some neurons which are not sensitive to MC joint movement. Frequencies higher than 150 c.p.s. silence all discharges.

In intact animals, sudden flexion of the MC joint causes an extension of this joint in the same limb, similar to the myotatic reflex in the vertebrates. Removal of this accessory-flexor proprioceptive system, markedly reduces and in some cases even abolishes this reflex. This clearly indicates the role of the accessory-flexor sensory system in proprioception. (U.S.P.H.S. Pre-doctoral trainee in Physiology and partially supported by grant B-1624 to Melvin J. Cohen from the U.S.P.H.S.)

142

ANTONE GARDNER JACOBSON, University of Texas. Factors influencing the positioning of the placodal derivities in the newt. (15 min.)

The placodal derivaties have been shown to be induced in amphibians by the synergistic activity of anterior endoderm and/or mesoderm, and by a neural derivative, forebrain for nose, retina for lens, and hindbrain for ear. My investigations have been directed toward the question of what makes the nose, lens and ear form in their respective positions. The most obvious answer that regional specificity is imposed by the respective neural inductors is contradicted by the formation of the placodal structures in their proper positions in the absence of their respective neural inductors. Defect, explant, and transplant experiments testing most of the possible combinations of presumptive placodal epidermis and the tissues in its environment indicate that the epidermis is labile with respect to nose-lens-ear position in neurula stages, and organ specificity is gradually imposed through interaction with surrounding tissues and through interaction among the developing placodal structures. (Supported by grant RG-5734 (C2) from the U.S.P.H.S.)

168

OSCAR CHARLES JAFFEE, University of Buffalo. On the morphogenesis of cardiac jelly and its role in the development of the heart. (12 min.)

Previous studies (Jaffee, Anat. Rec. 137:366,

1960) have shown that vascular forces influence the molding of valves and other cardiac structures. An analysis of the role of these forces on the formation of cardiac jelly is presented, based chiefly on the developing heart of the frog *(Rana pipiens)* at hatching (stage 20, Shumway) when the jelly comprises the functional valves of the heart.

Patterns of venous flow through the heart were modified by unilateral pronephrectomy. Changes in the configuration of the jelly were produced and, in some cases, jelly was displaced into the ventricle, a condition never observed in the normals. The results have made possible an analysis of the effects of physical forces on the development of cardiac structure, and a discussion of the theories developed, notably that of Spitzer, will be presented.

The study also demonstrates that cardiac jelly is not directly replaced by cellular tissue, but rather aids in the establishment of vascular patterns which, in turn, influence further cardiac development. This may be termed a feed-back system. (Supported by a grant from the Erie County Heart Association.)

201

THEODORE L. JAHN and MICHAEL BROWN, University of California, Los Angeles. The mechanism of pattern formation in ciliate cultures.

As most ciliates swim they produce a turbulent vortex ring. This results from Newton's third law of motion and occurs in spite of the low Reynolds number (about 10^{-2}) of the organisms. Any other ciliate which enters this ring may be hydrodynamically linked to the first organism and tends to follow it, with resulting greater velocity for both. Others could be added to the anterior end, resulting in further increases in velocity. Calculations of the mean free path show that 7% or more of the organisms in a randomly distributed culture could approach other organisms posteriorly within a 90° solid angle each second.

From examinations of the velocity profile along the lateral surfaces it can be predicted that two organisms swimming approximately parallel courses will tend to turn toward each other because of non-uniform field flow. Calculations of the Bernoulli forces show that two paramecia swimming parallel 50μ apart will be drawn toward each other with a velocity of about 77μ/sec. These effects are additive.

We have demonstrated turbulence patterns by means of cinematographic and long exposure single frame photographic methods.

It seems as if the presence of vortex rings and of geotaxis, and the effects of non-uniform flow fields and of Bernoulli forces can explain pattern formation in *Tetrahymena* (see Jahn, Brown and Winet, these Proceedings). (Supported by O.N.R. grant 233(65) and U.S.P.H.S. grant 6462.)

133

THEODORE L. JAHN, MICHAEL BROWN and HOWARD WINET, University of California, Los Angeles. Pattern formation in cultures of *Tetrahymena*. (15 min.)

The observations of Loefer and Mefferd (1952) on pattern formation of *Tetrahymena* in Petri dishes have been extended by means of cinematography and single photographs of long exposure. Net movement in the horizontal columns of the pattern is toward the nearest node, and there is a column of organisms moving downward beneath each node. When these organisms approach the bottom of the container they turn horizontally in a radiating pattern, then upward, and join the horizontal columns apparently at random.

Organisms killed with alcohol and stained with fuchsin may join the pattern. These accumulate on the bottom of the container, mostly under the nodes, and to a lesser extent under the lines.

Organisms in vertical containers, made from 2 cm coverslips mounted 1.5 mm apart, form a pattern of one vertical column, after they accumulate by geotaxis at the top. If the vertical chamber is 0.5 mm thick no pattern is formed. If a horizontal chamber is 1.5 mm thick no pattern is formed.

Carbon dioxide causes a doubling of the columns, with each pair separated by a clear space. The center of each node is also clear. In vertical cultures two vertical columns occur with a clear space between. Carbon dioxide in the atmosphere causes organisms to move downward, leaving a clear layer beneath the surface.

Most or all of these phenomena can be explained on a hydrodynamic basis. (See Jahn and Brown, this issue.) (Supported by O.N.R. grant 233(65) and U.S.P.H.S. grant 6462.)

202

SOPHIE JAKOWSKA, New York Aquarium, New York Zoological Society. Syncoelous parabiosis of adult newts, *Diemictylus viridescens*.

Genetically random adult newts from North Carolina were sutured male to male or male to female along a 2 cm lateral incision in the body wall, resulting in a common coelomic cavity. The term syncoelous parabiosis differentiates this condition from the so-called "coelomic" parabiosis of mammals, in which abdominal, not coelomic, cavities were united.

No gross ill effects or abnormal behavior were observed in parabiotic pairs. Active locomotion at room temperature occasionally resulted in partial evisceration; this complication was avoided at 10-15°C. Mechanical restraining was impractical, interfering with respiratory movements. To date, maximum survival of 10 days was observed for pairs kept at 22-32°C, and of 16 days for pairs kept at 10-15°C. Survival was not influenced by the sex of the partners. Union for 10 days, followed by spontaneous separation did not affect survival of ex-parabionts. Early surgical separation from a dead partner prevented the death of the other. Exudates collected from the common coelom 24 hours after union consisted principally of polymorphonuclear leukocytes. Lymphocytes and lymphoblasts were predominant in the coelomic exudate 24 hours after re-union of ex-parabionts which had previously remained united for 10 days but had separated spontaneously.

Different length of survival of various parabiotic pairs and occasional sponstaneous separation at room temperature may reflect the degree of genetic difference between partners. In the absence of inbred strains of *Diemictylus viridescens*, syncoelous parabiosis of newts from geographically isolated populations may contribute to the understanding of gene dosage effects.

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SOPHIE JAKOWSKA, ROSS F. NIGRELLI and ARNOLD H. SPARROW, New York Aquarium,

New York Zoological Society and Brookhaven National Laboratory. Additional radiobiological studies on normal and anemic newts, *Diemictylus viridescens.*

Some chemical changes, specific for pseudoerythroplastic anemia, a condition found exclusively in this species of urodeles and characterized by nuclear hypertrophy of the erythrocytes, were sought by stressing adult male newts with or without spontaneous anemia with a single whole-body lethal X-ray dose of 9000 r. The animals were kept at room temperature (22-26°C) and samples of blood and hemopoietic organs were removed from these and from non-irradiated controls 6, 16 and 20 days after irradiation. Serum, hemolyzed whole blood and homogenates of liver and spleen were "finger-printed," either directly or following 24 hour hydrolysis at 100°C. Descending unidimensional paper chromatography in butanol:acetic acid:water solvent was used; the chromatograms were developed with ninhydrin and R_f values calculated for all fractions.

Fresh serum and homogenates of liver and spleen from irradiated normal and anemic newts and their respective controls, when applied directly to paper strips and dried prior to separation, yielded in each case 5 ninhydrin-positive areas. Hydrolyzates of whole hemolyzed blood and of spleen and liver homogenates from animals belonging to the experimental and control groups yielded under optimum conditions 12 different ninhydrin-positive fractions. The R_f values determined for fractions derived from materials from normal newts and from the other groups corresponded to each other. Apparently no chemical differences detectable by our procedure exist between normal and anemic newts in ninhydrin-positive fractions of blood and hemopoietic organs. (A portion of this work was carried out at Brookhaven National Laboratory under the auspices of the U.S.A.E.C.)

28

PHYLLIS J. JAY, University of California, Berkeley. Dominance relations of the common Indian langur monkey. (15 min.)

This report is based on field observation of free-ranging langur monkeys *(Presbytis entellus)* in Central and North India during 1958-1960. Troops of 5 to over 120 members occupy partially overlapping ranges of from 1 to 5½ square miles. Core areas within the range contain concentrations of food, water, and sleeping trees. Daily movement and seasonal use of range are discussed.

Male and female dominance hierarchies maintain the stability of a troop and integrate its activities. The male dominance hierarchy, stable, linear, and well defined is established and maintained primarily by subtle interactions with a minimum of violent, aggressive behavior. Correlation of dominance position with leadership of the troop, frequency of copulation, grooming, and other forms of social interaction are considered. The female dominance hierarchy is not linear and is less stable than that of the male. Temporary alliances of adult females can dominate both females and adult males. Interrelations of the two hierarchies and effects of dominance interactions on troop structure are discussed. (Supported by Fellowship No. MF-12,120-C1 from the U.S.P.H.S.)

204

KLAUS D. KALLMAN, New York Zoological Society. Genetic homogeneity of a small isolated population of viviparous fish as revealed by tissue transplantation.

In small isolated populations inbreeding is likely to occur which eventually may result in an appreciable degree of homozygosity or genetic homogeneity among its members. In such populations tissue transplants among wild-caught individuals may succeed. Such an analysis has been made on the viviparous teleost, *Xiphophorus couchianus,* the entire population of which is restricted to three springs, isolated from one another, in the Huastecan canyon near Monterrey.

In two trips made three months apart only three pairs of fish were found in the upper portions of spring #1 and four pairs in spring #2. Downstream, before the water seeps into the ground, these springs are channelled into irrigation ditches and here *X. couchianus* numbers several hundreds. A series of waterfalls prevents these fish from reaching the upper portions of the springs. In spring #3 only 300 yards long, there were about 50-100 pairs of *X. couchianus.*

Of 143 intra-sib fin transplants made among the immediate offspring of four females from springs #1 and 2, 30% were successful, while only 15% of 80 transplants were successful among the offspring from females of spring #3. Many of the unsuccessful grafts survived for several weeks before they were rejected. So far no "take" has been obtained when host and donor descended from females belonging to different springs. That the high percentage of "takes" is not due to an immunological unresponsiveness peculiar to *X. couchianus,* was shown by the fact that all *X. couchianus* rejected fin grafts from donors of the closely related species *X. maculatus* within a week or two. (Supported by research fellowship HF-9500 to the author and by grant C-4945 to Dr. Sylvia Greenberg from the U.S.P.H.S.)

163

DAVID B. KING and JAMES G. SNEDECOR, University of Massachusetts. Glycogen turnover in the chick glycogen body. (15 min.)

Week old White Rock chicks were injected with 50 microcuries of C^{14}-glucose and the expired CO_2 collected in NaOH. The chicks were sacrificed at 3, 8, 18, or 48 hours after injection and the level of isotope in the glycogen body glycogen, liver glycogen, blood glucose and expired CO_2 determined. The extracted glycogen was digested with β-amylase prior to analysis for C^{14} in order to determine separately the activities of the peripheral tiers (maltose) and inner core (limit dextrin) of the glycogen molecule. All substances except the expired CO_2 were oxidized to CO_2 and all were precipitated as $BaCO_3$. The activity in the samples of $BaCO_3$ was counted with a windowless flow counter and recorded as counts per minute per millimole of CO_2.

The specific activity of glycogen body glycogen, expressed as percent of the injected specific activity, was insignificant at 3 hours after injection of C^{14}-glucose, .015% at 8 hours, .040% at 18 hours, and .016% at 48 hours after injection, indicating an incorporation and release of the C^{14}-glucose during the 48-hour period. A greater replacement of glucose units occurred in the maltose fraction of both the glycogen body and liver glyco-

gen than in the more stable limit dextrin fraction. The rate of turnover of glycogen in the glycogen body was slower than that for the liver.

Incorporation and a release of C^{14}-glucose by the glycogen of the glycogen body within 48 hours after injection indicates that glycogenesis and glycogenolysis take place in this tissue. In spite of the constancy in the amount of glycogen in the glycogen body and its refractoriness to conditions which might be expected to alter tissue glycogen, it seems certain from the present study that the stable concentration of glycogen, rather than being a static situation, must be the result of a nicely regulated balance between glycogenesis and glycogenolysis. (Supported by grant A-1266 from the U.S.P.H.S.)

37

R. C. KING and R. P. MILLS, Northwestern University and Yale University. Nuclear cytoplasmic exchange during oogenesis in *Drosophila.* (15 min.)

A number of findings in *Drosophila melanogaster* suggest that a contribution is made by the nurse cell nuclei to the ooplasm during oogenesis. The rate of DNA synthesis in nurse cell nuclei reaches a maximum just prior to vitellogenesis. During vitellogenesis there is a very rapid uptake of labeled RNA precursors by nurse cell nucleoli. Vitellogenesis is retarded or abolished in the ovaries of wild type females fed upon diets poisoned by antimetabolites which inhibit nucleic acid synthesis. In the ovaries of females homozygous for certain recessive, female sterile genes (*mr*[2], *fs 2.1, rn, sn*[3Oa], and *ras*[4]) retardation of yolk formation is accompanied by a reduction in the amount of Feulgen-positive material in the nuclei of the nurse cells. Furthermore there is evidence during yolk formation for the emission into the cytoplasm of nuclear material enclosed in blebs originating from the nuclear envelopes of nurse cells. More recent electron micrographic studies on developing egg chambers at pre-yolk stages in *Drosophila willistoni* have uncovered another particularly interesting variety of nuclear inclusion. These bodies which may reach one micron in longest dimension appear to be composed of multi-compartmented membranous vesicles. They are often seen in intimate contact with the inner membrane of the nuclear envelope, and vesiculate bodies similar in morphology except that they are surrounded by additional membranes are found in the nurse cell cytoplasm and ooplasm. At still earlier stages the oocyte nucleus produces inclusions of a different appearance, and bodies of similar morphology rich in protein and polysaccharide are found in the ooplasm in great abundance.

137

C. WARD KISCHER, Iowa State University. (Introduced by John W. Saunders, Jr.) Fine structure of the developing down feather. (15 min.)

Down feathers from primordial to fully-formed stages were excised from the back skin of developing chick embryos, fixed in isotonic osmium tetroxide and embedded in pre-polymerized methacrylate. Sections were viewed in an RCA EMU-3F electron microscope. The dermo-epidermal boundary was given special attention in regions of the feather known to be rich in alkaline phosphatase and ribonucleoprotein.

The basalmost epidermal cells were columnar, with centrally-located nuclei. The lower ends of cytoplasm were often bent or intruded beneath adjacent cells next to the dermal boundary. Mitochondria were abundant in the basal cytoplasm, and varied from small spheres to long rods of 19,000 Å in length and 4,600 Å in width. Some of the longer mitochondria were tortuous and vermiform. They showed the usual double wall. The cristae were well-developed and sometimes extended across the complete diameter.

In the region of the formed barb ridges, the mitochondria were uniformly small and spherical, often in close association with small bundles of membranes similar to endoplasmic reticulum.

The cytoplasm of the basal epidermal and adjoining pulp cells contained numerous membrane-bounded vesicles, sometimes clear, sometimes not. Occasionally these had an outer coating of small granules which resembled ribosomes on endoplasmic reticular membranes.

The dermal and epidermal cells were separated by a distance of about 400 Å. The interspace between the bounding membranes contained tiny granules. Occasionally, small invaginations were observed on the adjoining epidermal cell membranes similar to pinocytotic vesicles in protozoa. The existence of a separate basement membrane is open to question. (Supported by grant RG-3813 (C8) from the U.S.P.H.S.)

162

HERMAN KLEEREKOPER, McMaster University. The role of chemical sense in the orientation of *Petromyzon marinus.* (Motion picture, 15 min.)

The activity pattern of *Petromyzon marinus* is affected by the introduction of water containing the scent of fish into the experimental tank. Scent of trout was chemically analyzed and eleven of its components isolated. The individual components were then introduced into the lamprey tank in lieu of the whole scent, in order to ascertain whether a single component could bring about the changes in activity pattern observed with whole scent. It was found that two substances could isolatedly effect the activity pattern: ethylene di-amine (C-H-N ratio 2-9-2, Rf value 18) and ethyl or di-methyl amine (C-H-N ratio 2-7-1, Rf value 32). None of nine other amines isolated were effective. The significance of whole scent and of the above isolates in the orientation of the lamprey was studied.

139

WILLIAM E. KOCH, Stanford University. Transmission of radioactive materials during induction *in vitro.* (Introduced by C. Grobstein) (15 min.)

The dorsal portion of the embryonic mouse (11 day) spinal cord, labeled with tritiated amino acids and separated in culture by a thin filter membrane (Millipore Filter Corp.) from 11-day metanephrogenic mesenchyme, will induce epithelial tubules to form in the mesenchyme. Labeled spinal cord separated from mesenchyme by two filter layers with an intervening cellophane layer will not induce tubules to form. Epithelial tubules will form if the cellophane is perforated by a 0.15mm hole; these tubules are localized just above the hole. Autoradiograms show no radioactive materials in the filter adjacent to the mesenchyme when an unperforated cellophane membrane is employed, although the mesenchymal tissue is labeled. Sig-

nificant grain counts are recorded in the mesenchyme-associated filter only when the cellophane has a hole; moreover, this radioactivity is localized just opposite the hole. Mesenchyme in this same region opposite the hole shows more radioactivity than in regions lateral to the hole.

Mesenchyme cultured opposite labeled spinal cord accumulates, therefore, radioactive materials which can be detected in the filter, and radioactive materials which can pass through an unperforated cellophane membrane and are not detectable in the filter. Kidney tubule differentiation is correlated most closely with the former type of transferred materials. (Supported by grant G-11709 (N.S.F.) to C. Grobstein.)

122

CHARLES D. KOCHAKIAN, University of Alabama Medical Center. Biochemical changes at the cellular level induced by androgens. (30 min.)

The anabolic action of androgens is exhibited in many tissues other than accessory sex organs. These changes in tissue growth are accompanied by changes in the activities of many enzymes concerned with intermediary metabolism. The changes, furthermore, are not only specific for certain tissues but also for species of animal. The androgens also influence the enzymes concerned with protein synthesis. The amino acid activating enzymes of the prostate and temporal muscle of the guinea pig decrease in proportion to the decrease in weight of the tissues and are restored by androgen administration. The enzymes of the seminal vesicles, on the other hand, decrease in specific activity after castration and are increased on androgen administration. The enzymes of the kidney and liver of the mouse behave like those of the prostate and temporal muscle of the guinea pig. The third step in the protein biosynthetic process, the incorporation of amino acid into protein, is slightly decreased by castration and increased by androgen administration in the kidney of the mouse and the seminal vesicle, prostate and temporal muscle of the guinea pig. The growth of the tissues under the stimulation of the androgens also shows changes in the nucleic acid concentrations. Thus, the microsomal ribonucleic acids of the kidney, seminal vesicle and prostate are rapidly increased to above normal levels during the period of growth and then return to normal levels as the tissues obtain their maximum increase in weight.

205

MICHAEL J. LAMARCA and PERRY W. GILBERT, Cornell University. The clasper and clasper gland of *Urolophus jamaicensis*.

The claspers of male *Urolophus jamaicensis* are proportionately shorter than those of other batoids and their growth rate never exceeds that of the body. Clasper skeletal elements include the basale, 3 connecting pieces, the appendix stem, and 5 distal cartilages. Claspers are flexed medially through 85° in the plane of the body by contraction of the adductor, internal flexor, and external flexor muscles supplied by spinal nerves 60-66. A dilatator muscle widens the hypopyle and anchors the flexed clasper in the female during copulation. Evidence suggests *Urolophus* mates venter to venter.

The clasper groove communicates proximally with a muscular clasper sac on the ventral surface of the pelvic fin. An elongate clasper gland, consisting of tubular elements collectively sheathed by striated muscle, projects ventrally into the sac. Simple columnar epithelium lines the clasper gland tubules and secretes a muco- or a glycoprotein and a phospholipid-containing lipoprotein. Both protein moieties contain tyrosine and tryptophan. Contraction of the muscle sheath about the gland expresses secretion from tubule lumina into the clasper sac via a longitudinal series of papillae; contraction of the sac forces the secretion into the clasper groove where it mixes with spermatozoa.

The clasper gland secretion is a white, viscous fluid, having a pH of 6.2, which coagulates in water. Spermatozoa suspended in the secretion remain motile ten times longer than in sea water. The secretion probably seals the clasper groove into a closed tube and acts as a nutritive and/or protective medium for sperm transport. (The field work for this study was conducted at the Lerner Marine Laboratory of the American Museum of Natural History and was supported in part by a grant from the N.S.F.)

121

HENRY LARDY and YA-PIN LEE, Institute for Enzyme Research, University of Wisconsin. Cellular effects of the thyroid hormone in different organs and species. (30 min.)

Although thyroxine and related iodinated thyronines are formed in many primitive animals (e.g. Gorgonia) they do not appear to have a metabolic effect in these species. Cells that specialize in iodide concentration and thyroxine synthesis first appear in the subphylum Urochordata. Very few studies have been made of thyroid hormone function in subphyla other than Amphibia, Aves and Mammalia. The most dramatic effect of thyroid hormone in Amphibians is the induction of metamorphosis. Studies by Frieden and by Cohen have disclosed that the activity of several enzymes involved in urea formation increases strikingly following administration of thyroid hormones to the larval form of certain amphibian species. Great increases in acid phosphatase and proteolytic enzyme activity in the tail tissue of tadpoles (Weber and Niehus) occur simultaneously with the degeneration of this organ at the time of metamorphosis. The time sequence of the enzyme changes in relation to overt metamorphosis will be discussed.

In mammals, thyroid hormone seems not to influence the amount of enzymes involved in urea formation but it does regulate the amount of mitochondrial α-glycerophosphate dehydrogenase in certain organs. Mitochondria from thyroidectomized rats' livers contain less than $\frac{1}{10}$th the normal amount of this dehydrogenase; thyroid feeding enhances the amount by 20 fold above the norm. The amount of α-glycerophosphate dehydrogenase in liver, kidney, heart and diaphragm is influenced by the thyroid hormone; that of the spleen, brain, lung, testis and ovary is not. This corresponds with the effect of the hormone, administered *in vivo*, on the metabolic rate of the surviving tissues. Thyroid hormones do not influence the activity of mitochondrial α-glycerophosphate dehydrogenase in the frog or tadpole. Thyroid hormones probably exert their influence through their effects on enzyme formation but whether they act directly as derepressors or catalyze the destruction of repressors has not yet been determined.

206

JOSEPH R. LARSEN, JR., University of Pennsylvania. Fine structure of the chemosensory hairs of the blowfly, *Phormia regina*.

Chemosensory hairs from the labellum of the blowfly, *Phormia regina*, have come under extensive study by various workers, who have failed to reveal any differences among them except of size. Dethier (Quart. Rev. Biol., 1955), using a methylene blue technique, described three neurones supplying each hair, only two of which ascend the shaft. In this study the labellum was removed from the fly and fixed 2-4 hrs. in Palades solution of osmium tetroxide and embedded in methacrylate. Sections were cut at about 90 Mμ with a Porter-Blum microtome using glass knives.

The chemosensory hairs of the labellum are characterized by the presence of the two lumina, one thin-walled, the other thick-walled which contains the distal processes of the subhypodermal bipolar sensory neurones. In all of the material observed, the thick-walled cavity always contained more than two nerve fibers in cross section. All of the sections examined show at least three fibers in this cavity and some sections were seen showing this cavity containing four and five fibers, respectfully, indicating the possibility of there being two or three species of hair on the labellum. Recent electrophysiological evidence supports this claim (Mellon and Evans, Amer. Zool., 1961). All of the nerve fibers are enclosed in a scolopoid structure which projects into the trichogen cell. In *Phormia* this sheath, while extending into the trichogen cell, does not extend upward into the hair itself but terminates at the base of the shaft. It is not connected to, or part of, the nerve fibers as suggested by earlier workers.

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IRVIN E. LAWRENCE, JR., University of Wyoming. Mesodermal-ectodermal interactions in the development of the comb. (Introduced by B. S. Wenger) (15 min.)

A study was made of factors involved in comb development in the chick to determine the relationships between ectodermal and mesodermal components. The earliest determination of the primordium based upon the ability to differentiate comb in chorio-allantoic grafts is Hamburger-Hamilton stage 24. Ten different combinations of prospective and nonprospective tissues were made, incorporating homoplastic, heteroplastic and xenoplastic combinations in chorio-allantoic grafts. Presumptive comb mesoderm of the New Hampshire Red (single comb) differentiated a single-comb when combined with non-comb ectoderm of the New Hampshire Red, the presumptive comb ectoderm of the Buttercup (duplex comb), non-comb ectoderm of the Buttercup and forehead ectoderm of the duck. The Buttercup presumptive comb mesoderm developed duplex characteristics in association with non-comb ectoderm of the Buttercup, presumptive comb ectoderm of the New Hampshire Red, non-comb ectoderm of the New Hampshire Red and duck forehead ectoderm. Presumptive comb ectoderm of neither the New Hampshire Red nor the Buttercup produced a recognizable comb when combined with mesoderm from a number of non-comb sources including forehead mesoderm of the duck. Ectoderm from presumptive feather tracts did not develop feather papillae when incorporated into a comb. (Supported by a General Research Grant from the University of Kansas to Byron S. Wenger.)

136

ROLAND LESSEPS, Johns Hopkins University. An electron microscopic study of dissociated embryonic cell surfaces. (Introduced by M. S. Steinberg) (15 min.)

It is common practice to treat embryonic tissues with either proteolytic enzymes, EDTA or an alkaline solution to dissociate the tissues into a suspension of single cells. The following electron microscopic study was undertaken to see what detectable effect, if any, these agents produce upon the cell, especially the cell surface.

Heart ventricle, liver and pigmented retina were dissected from 5-day embryonic chicks and epidermis from 7- or 8-day embryos. The agents used for dissociation were dissolved in Ca-Mg-free Tyrode solution and were as follows: 3% trypsin plus 1% pancreatin for heart and liver; 0.1% EDTA for heart; pH 10 for epidermis; 0.1% papain plus 0.02% cysteine HCl plus 0.124% EDTA for pigmented retina. Each treatment was followed by a brief mechanical vibration to effect the final dissociation.

The investigation is still in progress, but it is already clear that the membrane at or near the cell surface appears undamaged by any of the dissociation procedures used. In high magnification micrographs this membrane was resolved into the typical unit membrane of two electron dense lines separated by a lighter zone.

The dissociated cells had numerous pseudopods, long filiform processes, and low undulations of the cell surface. Most of these had radii of curvature in the order of 0.1μ, which is the theoretical value Bangham and Pethica give as required to allow regions of two cells to approach within 5 Å of one another. Calcium bridges could span this 5 Å distance and bind the two cells together. (Supported by U.S.P.H.S. Predoctoral Research Fellowship GF-9762.)

57

ESTEES P. LEVINE, Hopkins Marine Station, Stanford University. (Currently, San Jose State College). Some phlebobranch affinities of the structure, reproduction, development and concentration of metals in the aplousobranch ascidian, *Eudistoma ritteri*. (15 min.)

The system of classification of the class Ascidiacea in widest current use divides the group into three orders on the basis of pharyngeal structure. The Phlebobranchiata, whose members possess internal longitudinal vessels, is separated from the aplousobranch ascidians locking these vessels. Evidence has been accumulating that this ordinal division is not a natural one and that the Polycitoridae have clear affinities with the phlebobranch Diazonidae.

Eudistoma ritteri is a colonial, polycitorid, aplousobranch ascidian whose zooids do not form systems. They possess a merosomatous body form terminating in a slender vascular process, and epicardia which fuse to form a posterior median chamber. Sexual and asexual reproductive cycles are separate. Budding occurs by strobilation of the esophageal region of the abdomen involving internal autolysis at the points of local epidermal ingrowth. Morphogenesis begins prior to bud iso-

lation by fusion of posterior limbs of the alimentary canal above each point of constriction. The branchial sac is rebuilt by fusion of the right and left epicardial sacs to which the anterior end of the esophagus also fuses. From the anterior end of the dorsal cord the neural complex is reconstituted; and posteriorly in the body the heart and pericardium from mesenchyme cells of the ventral blood vessel.

Eudistoma ritteri has a vanadium-free "green-cell" blood corpuscle. Body tissues are shown by quantitative spectrographic analysis to contain up to the following amounts of related metals (parts per million of dry weight): titanium, 1512; vanadium, 471; chromium, 144. Tunic fluid shows a pH of 1.5 due to the presence of sulfuric acid.

60

DANIEL M. LILLY, BERNADETTE A. HERBST and ROSALIE H. STILLWELL, St. John's University, New York. A reciprocal stimulating effect on growth in two species of ciliates. (15 min.)

Two common species of ciliates, *Stylonychia pustulata* and *Paramecium caudatum*, are often found together under natural conditions. Separate axenic cultures of each species have been established and maintained under laboratory conditions. When the two species were grown together, however, each species had a higher rate of division than in control cultures where each was growing separately. The increased rate of growth was noted first in *Stylonychia* from the second to the eighth day when the population in the mixed cultures was approximately double that in the controls. The increased rate of growth in *Paramecium* was less marked during the first 8 days, but at the end of 16 days the *Paramecium* population was 60% more in the mixed cultures. The stimulation of growth was apparently due to factors in the culture medium. A medium conditioned by *Paramecium* supported better growth of *Stylonychia* and a medium conditioned by *Stylonychia* supported better growth of *Paramecium*. If either type of conditioned medium was autoclaved the growth promoting effect was lost, but heating to 50° C did not result in complete inactivation. Quick freezing and thawing of the conditioning organisms was the simplest method of eliminating them before inoculating the test organisms. Centrifugation was also effective but more time consuming. Preliminary work indicated that the stimulating factors could be concentrated and transferred when dried on filter paper. Hence paper chromatography may be useful in further study of these factors. (Supported by grant E-1506 from the U.S.P.H.S.)

86

DAVID T. LINDSAY, Johns Hopkins University. Properties of lactate dehydrogenase isozymes from developing chicken tissue. (Introduced by C. L. Markert) (15 min.)

Starch gel electrophoresis of lactate dehydrogenase from tissues of many different species reveals that the enzyme exists in several isozymic forms. Some of these isozymes are common to several different tissues and have identical electrophoretic mobilities, but whether other properties of such isozymes are also identical has not yet been demonstrated.

Our approach to this problem is to study various properties of the isozymes from chicken tissues, including antigenic specificity based upon antibody prepared in rabbits. Electrophoresis on starch gel in citrate-phosphate buffer pH 7.0 at six volts per centimeter of tissues homogenized in cold water demonstrates isozymes which are common to various tissues of different ages. Thus far the largest number of isozymes found in any tissue has been five (blood) but, more often, tissues contain three (testis) or four (liver). In certain tissues the isozymic pattern gradually changes during development, but almost all tissues have in common at least two isozymes that move toward the anode. Although more diversity seems to exist in the isozymes moving toward the cathode, some of these are found in several tissues. The results of a comparative study of the properties of isozymes with identical electrophoretic mobility but obtained from different tissues will be reported. (Supported by N.S.F. grant G-4549 to C. L. Markert.)

35

CHARLES F. LYTLE, Tulane University. Ultrastructural specialization in the gastroderm cells of a hydromedusa. (15 min.)

Phylogenetically the Cnidaria are among the simplest of multicellular animals, but cytologically they are highly complex. Certain cell types of Cnidarians exhibit structural specializations associated with several different functions. The digestive cells of the gastrodermis of the freshwater medusa *Craspedacusta* are an example of such a complex cell type, and their fine structure has been examined in the present study.

The digestive cells of *Craspedacusta* lining the cavity of the gonads are specialized into three distinct regions. Their innermost region is active in the uptake and transport of materials from the gastrovascular cavity. Many pseudopodial projections extend into the cavity from the surface of these cells and their peripheral cytoplasm contains many vacuoles, ranging from a fraction of a micron to several microns in diameter.

The central region of the cells bears one to several digestive vacuoles and is specialized for the enzymatic degradation of food materials. The basal region of the cells contains a large nucleus surrounded by concentric arrays of endoplasmic reticulum with associated small granules. This region is believed to be the primary site of utilization of the small molecular units made available by the digestive region of the cells.

Details of the fine structure of these cells and their possible functional significance will be discussed as an illustration of the complex chemical and physical organization of the cells of Cnidaria. (Supported by research grant RG-8140 from the U.S.P.H.S.)

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I. A. MACCHI, LELAND C. WYMAN, PATRICIA GRIFFIN and FRANK RIZZO, Boston University. *In vitro* adrenocortical response of regenerating rat adrenal mesenteric autografts to graded doses of Armour and Wilson adrenocorticotropin.

A possible abnormality in corticosteroidogenic response of regenerating adrenals to adrenocorticotropin (ACTH) stimulation has been investigated *in vitro* by direct quantitative methods.

Adrenals were autotransplanted to the intestinal mesentery of Charles River CD (Sprague-Dawley)

male albino rats and allowed to regenerate 30 days. Bisected glands were incubated in Krebs-Ringer-bicarbonate-glucose medium (pH 7.4) at 38°C in the absence or presence of Armour ACTHar La-1A and Wilson oxycellulose purified ACTH in doses of 10-1000 M.U./100 mg. adrenal. Secretion was measured in duplicate determinations by blue tetrazolium (BT) and ultraviolet (UV) analysis of unpurified methylene dichloride extract residues of incubation fluid. Comparison of response to ACTH at each dose level was made between transplants and intact adrenals similarly treated. Relative potencies of the two ACTH preparations and corticosteroidogenic activity of concentrations employed were predetermined.

Armour ACTH at all doses did not increase BT or UV output of regenerated glands to the same extent as that of intact controls, although differences between means of the two groups were not statistically significant at the 5% level. In contrast, Wilson ACTH generally increased BT and UV output of transplants to a greater extent than that of controls, but also without statistically significant differences between means. Consistent differences were not observed between intact glands and transplants in per cent increase in response obtained at all dose levels of both ACTH preparations. Findings suggest that rat adrenal mesenteric autografts regenerated 30 days are not grossly abnormal in response to *in vitro* stimulation by ACTH. (Supported by grant C-3989 from the U.S.P.H.S. and contract A^T(30-1) 1254 with the U.S.A.E.C.)

54

RICHARD E. MACMILLEN, Pomona College. The role of water in the population ecology of a southern California semi-desert rodent fauna. (15 min.)

A rodent population inhabiting the semi-desert coastal lowlands of the San Gabriel Mountains in southern California was investigated. The population consisted of *Neotoma fuscipes, N. lepida, Peromyscus californicus, P. eremicus, P. maniculatus, Dipodomys agilis* and *Perognathus fallax.* Monthly trapping revealed an annual population fluctuation with a midwinter peak and a midsummer low. All of the species followed this cycle with the exception of *Neotoma lepida,* whose numbers varied indirectly with those of the remaining population. Studies of the water relations indicated that, with the exception of *Perognathus fallax,* all the species require some water which they obtain primarily by eating vegetation. Wide use is made of succulent prickly pear for water, especially during the dry season. An analysis of interspecific social behavior revealed the presence of a dominance hierarchy with *Neotoma lepida* the dominant species. These findings can be fitted into an internally consistent explanation of the observed population fluctuation: 1) numbers of *Neotoma lepida* vary with the reproductive season of that species; 2) as *N. lepida* numbers increase during summer, and as most of the vegetation becomes progressively drier, individuals of that species establish nests in all available prickly pear patches, aggressively excluding other rodents from access to this succulent water source; 3) with water limited, species other than *N. lepida* become diminished in number; 4) following cessation of reproduction, *N. lepida* levels drop through mortality; 5) reciprocal increases in populations of other species occur as prickly pear again becomes available, and as other plants become more succulent due to cooler weather and rain, thereby producing more water for more animals.

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F. HAROLD McCUTCHEON, University of Pennsylvania. Swimbladder volume control in pinfish, *Lagodon rhomboides* (Linn.). (15 min.)

The rate of gas secretion was directly measured, under constant negative buoyancy, over continuous periods up to 10 hrs and intermittently for as long as 4 days. A maximum secretion rate of 0.43 ml/hr (fish 11.2 cm long) was observed over 10 hr period. This rate is about 26% of swimbladder volume (SBV) per hour. Average secretion rate for 5 fish was 18% (S.D. 5.5) SBV/hr. Results indicate that a pinfish can restore neutral buoyancy at a maximum of about 4 hours for each 5 fathoms deeper it moves. Swimbladder pressure (SBP) was photokymographically recorded a) when fish was moved through 45 cm range in depth, b) when SBV was varied 10-50% by gas addition and c) while fish swam or yawned. At neutral buoyancy, 50% increased SBV resulted in 2.4 cm H_2O increased pressure concomitantly. Yawn pressure was about 0.2-0.5 cm H_2O. Change in depth brought concomitant but not equivalent SBP change (e.g. up 42 cm reduced SBP 36 cm H_2O). Swim movements *in situ* varied SBP 0.5-1.0 cm H_2O, and strong diving thrusts included 5-20 cm H_2O momentary compression. Slow tonic compression (1-4 min) could raise SBP about 4 cm H_2O and maintain buoyancy change thus produced. Reflex muscular regulation of buoyancy appears limited to about 0.5% of SBV, and the bladder effector complex exhibits large compliance. (Supported by award from the N.S.F.)

55

EDITH KRUGELIS MACRAE, College of Medicine, University of Illinois. The fine structure of planarian rhabdites. (15 min.)

Epidermal and subepidermal rhabdites of embryo and adult planaria, *Dugesia dorotocephala,* were studied by electron microscopy. Embryos, dissected out of cocoons about 5 days before hatching, and adults were fixed in buffered O_8O_4 (Palade, J. Exp. Med., 95, 1952), embedded in Epon 812 mixture, stained in uranyl acetate and observed in a RCA EM3 electron microscope. Rhabdites showed a distinct granular structure in both embryonic and adult stages. The granules tended to be more densely packed in the interior of the rhabdite; this difference in arrangement was more pronounced for epidermal than subepidermal rhabdites, and for adult than embryonic rhabdites. A microfibrillar structure was observed parallel to the longtitudinal axis of the rhabdites. A fine limiting membrane was seen around the rhabdites. Mitochondria and agranular membranes and vesicles were present in the vicinity of the rhabdites.

The possible chemical components of the rhabdite granules may include porphyrin, which has been localized in rhabdites by fluorescence microscopy studies, and proteins, which have been detected in rhabdites by histochemical staining. (Supported by grant A-3980 from the U.S.P.H.S.)

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EDITH KRUGELIS MACRAE, College of Medicine, University of Illinois. Incorporation

of delta-aminolevulinic acid-4-C-14 into uroporphyrin-containing structures in *Dugesia dorotocephala.*

Uroporphyin has been demonstrated by fluorescence microscopy to be localized in the planarian rhabdites. Delta-aminolevulinic acid (ALA) is a known precursor of porphyrin biosynthesis (Shemin and Russell, J. Am. Chem. Soc., 75, 1953). The present investigation was concerned with *in vivo* conversion of ALA marked with C^{14} into porphyrin, and its subsequent localization by radioautography in epidermal and subepidermal rhabdites. Starved animals were fed liver which was moistened with radioactive ALA. After one hour the liver was removed and the animals were washed with spring water. At daily intervals homogenates were made and centrifuged, and the radioactivity in supernatant and sedimentable fractions was compared. After one day, 20% of the radioactivity was in the sedimentable fraction; 30% was in sedimentable fraction after 2 days, 50% after 6 days, and 70% after 9 days.

Radioautographs were made of 5 micron sections of animals fixed in 100% ethyl alcohol 4 and 7 days after ALA uptake. Sections were covered with 'Kodak' AR-10 autoradiographic stripping film and left in contact for 19 days before development in D-19. Radioautographs revealed C^{14} concentrated in areas of location of epidermal and subepidermal rhabdites. C^{14} more pronounced in areas of subepidermal rhabdites, probably due to the fact that these rhabdites are contained within rhabdite-producing gland cells, and are actively synthesizing porphyrin. (Supported by grant A-3980 from the U.S.P.H.S.)

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MICHAEL J. MAHER, Albert Einstein College of Medicine. The effect of environmental temperature on metabolic response to thyroxine in the lizard, *Lacerta muralis.* (10 min.)

Previous work with the lizard, *Anolis carolinensis,* has shown that animals maintained at a constant environmental temperature of 30° C respond to thyroxine injection and TSH injection with a rise in oxygen consumption, and to thyroidectomy with a drop in oxygen consumption. Lizards maintained at room temperature (21-24° C) do not respond to any of these treatments. The present experiments demonstrate that this effect can be obtained with a single group of lizards by altering the environmental temperature.

Two groups of European lizards, *Lacerta muralis,* were maintained at an environmental temperature of 30° C. One group received daily saline injections containing 0.2 gamma of 1-thyroxine per gram body weight. The controls received the same volume of saline alone. Oxygen consumption was measured in a Warburg constant volume respirometer before treatment and weekly during treatment. After one week of treatment the oxygen consumption of animals receiving thyroxine averaged 21% above control levels, and after two weeks the difference was 38%. The environmental temperature was then changed to 20° C and the thyroxine injections continued. Within nine days the oxygen consumption of thyroxine treated animals was no different from that of controls. The animals were returned to 30° C and the injections continued. After one week the metabolism of treated animals was 45% above control values. At the end of the experiment QO_2S were measured of liver slices of the remaining animals. These values reflected the whole animal oxygen consumption measurements, with the livers of thyroxine treated animals having QO_2S averaging 35% higher than control livers.

These results indicate that metabolic response to thyroxine in lizards is dependent upon environmental temperature. (Supported by U.S.P.H.S. Fellowship BF-8711.)

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DOUGLAS MARSLAND and ARTHUR M. ZIMMERMAN, New York University and State University of New York, Downstate Medical Center. An analysis of the anti-mitotic action of heavy water.

Inseminated eggs of *Arbacia punctulata* were immersed at various times in artificial sea water containing 70-90% D_2O. Subsequently the effects were analyzed by pressure-centrifugation and by isolation of the mitotic apparatus, using the ethanol-digitonin method.

The D_2O treatments exert a stabilizing action upon the nuclear membrane and upon various gel structures, i.e. the aster, the spindle and the peripheral plasmagel layer of the cytoplasm. Prophase and metaphase eggs, placed in 80% D_2O sea water, remain "frozen" in their initial state for at least 30 minutes as judged by mitotic apparatus isolations made during and at the end of such an immersion period. The prophase figures displayed an intact nuclear membrane and plainly visible astral areas, whereas the metaphase figures showed an essentially normal arrangement of the chromosomes and a plainly fibrous structure in the spindle and asters.

The gel structure of the peripheral cytoplasm becomes definitely firmer. Gel strength measurements, made at 20° C by the pressure-centrifuge method, gave values which consistently were about 30% higher than normal. However, the slope of gel strength-pressure curve for D_2O treated eggs was the same as that of untreated controls.

Although the structure of the peripheral plasmagel layer was changed, the furrowing capacity of the eggs was not abolished by the D_2O treatment. Eggs immersed, even in 97% D_2O sea water, continued to develop the furrowing reaction which frequently succeeded in cleaving the egg, provided the immersion was not started until 2-3 minutes before the normal furrowing time. Also experimental furrowing, induced by drastic pressure-centrifugation, was often obtained, although the nuclei of the treated eggs were difficult to break, compared to controls. (Supported by grants C-807 and RG-7157, U.S.P.H.S.)

34

SISTER M. AUGUSTINE MATTINGLY, Oak Ridge National Laboratory and the Catholic University. Basic protein synthesis in the meristematic nucleus. (Introduced by R. J. Kimball) (10 min.)

Autoradiographic analysis of nuclear amino acid incorporation has been hindered by the rapid accumulation of cytoplasmic label. A technique for the isolation of meristematic nuclei, essentially free of cytoplasmic contamination, from primary roots of *Vicia faba* will be discussed. Autoradiographs of such nuclei, isolated from roots treated with

basic or non-basic tritiated amino acid solutions, show very rapid labeling of chromatin and nucleoli; the label in the latter is quite transitory and is rapidly washed out of the nucleoli by treatment with unlabeled amino acids. A fraction of chromatin label is also rapidly removed, but after this initial decrease in label, the average count drops very slowly and label is still encountered in the chromatin at the end of 48 hours. (Supported by grant CF-10,362 from the U.S.P.H.S.)

210

RAOUL MICHEL MAY, BERNADETTE COURTEY and JEAN-PIERRE DENÊFLE, Faculté des Sciences (Centre d'Orsay), University of Paris. *In vivo* observations on the transformation of medulloblasts into neurocytes in the chick embryo.

We cultured spinal cord fragments of 7-day chick embryos and made a continuous study of them, using de Fonbrune's oil chamber which we adapted to phase contrast cinematography, taking a picture every 10 seconds.

After one hour's cultivation we observed a rapid pulsation of the undifferentiated round cells, whose cytoplasm showed a constant movement of small dark granules. Cells isolated mechanically showed a pendular rotation of their nuclei superimposed on the pulsation.

As soon as little peripheral cones appeared on the medulloblasts, their pulsation ceased. A cone per cell lengthened rapidly, and vacuolated spaces appeared in the centre of this expansion. A part of the cellular mass became integrated in it, giving the cell a pear-shaped aspect. The expansion thickened but had no terminal differentiation, only slight lateral outgrowths.

About 5 hours after starting the culture, terminal outgrowths appeared on the budding fibers and their growth became accelerated. The terminal outgrowth at first bent back towards the perikaryon, sometimes even lying on it. Several ramifications were then formed, giving an anastomotic aspect to the fiber, which then began its linear outgrowth, almost always perpendicularly to the spinal cord fragment.

211

RAOUL MICHEL MAY and JANINE THIMOTHÉE, Faculté des Sciences (Centre d'Orsay), University of Paris. Action of various doses of X-rays on brephoplastic grafts of ovaries from a different strain in the mouse.

In a first series of 16 cases we verified that all brephoplastic grafts of ovaries made between individuals of the same albino (Swiss) or black (C 57 Black) strain gave positive and permanent results. Grafted within the anterior chamber of the eye of female castrated mice, the ovaries reached their adult state within a number of days, with formation of Graafian follicles and corpora lutea. In castrated males the ovaries also developed, but no corpora lutea were formed.

In a second series of 52 cases we transplanted similarly the ovaries of new-born albino mice into the eyes of adult black females. The ovaries formed only a few primary follicles during the first 8 days after the operation; these later disappeared and 21 days after the transplantation the grafts were completely invaded by lymphocytes and fibroblasts.

In a third series of 100 cases host black female mice received various dosages of X-rays, from 300 to 1350 r, two days before being ovariectomised and grafted with an ovary from a new-born albino mouse. In these intraocular grafts doses inferior to 600 r had no beneficial effect; the ovarian grafts degenerated as quickly as control grafts made between strains.

However, doses of X-rays between 600 and 1000 r (65 cases) were followed by development of the grafted ovaries up to the stage of Graafian follicles. No corpora lutea were formed, and degeneration set in 35 days after the graft. Dosages over 1000 r were lethal within 8 days.

The degeneration of these ovaries seems to be in relation with the regeneration of host antibody-producing cells which had been destroyed by the irradiation.

129

E. A. MAYNARD, Bermuda Biological Station and University of Michigan. An electrophoretic study of esterases in the nervous systems of several decapod Crustacea (15 min.)

In conjunction with histochemical studies of sectioned material, starch gel electrophoresis was used to separate esterases in the nervous systems of some decapod Crustacea. Weighed portions of supra- and subesophogeal ganglia, thoracic ganglia, and circumesophogeal connectives from *Panulirus argus, Panulirus guttatus, Homarus americanus, Ocypode albicans,* and *Gecarcinus lateralis* were homogenized with a known quantity of water and centrifuged at 4°C. The supernatants were subjected to electrophoresis in starch buffered with borate or Tris at pH 7.5, using voltage drops of 8v/cm (with borate buffer) or 4v/cm (with Tris buffer), for four hours at 28-30°C. Starch slabs were then incubated two to twelve hours at 4°C in alpha naphthyl acetate, -propionate, or -butyrate with a diazo salt. Some slabs were pre-incubated in a control buffer solution or in one of several inhibitors (10^{-4}M eserine sulfate, 10^{-4}M di-isopropylfluorophosphate, or 10^{-4}M parahydroxymercuribenzoic acid).

In the nervous systems of *Panulirus guttatus* and *Panulirus argus* there are 9 electrophoretically separable bands active against the above substrates. Within one species, these bands are characterized by different degrees of reactivity in the 3 substrates, and by different sensitivities to the various inhibitors. Also, the bands differ in relative enzymatic activity in different regions of the nervous system (olfactory and accessory lobes compared with the rest of the brain; de-sheathed brain *vs.* the isolated sheath; brain *vs.* circumesophogeal connective). Between species, bands differ in electrophoretic mobility and in relative intensity of enzymatic activity. (Supported by U.S.P.H.S. grant M-5639(A) and a grant-in-aid from the Bermuda Biological Station.)

111

D. M. MAYNARD, M. J. COHEN and R. B. STEPHENS, Bermuda Biological Station, University of Michigan and University of Oregon. Functional connections in a regenerated heteromorphic antennule. (15 min.)

In an adult spiny lobster, *Panulirus argus,* a structure morphologically similar to an outer antennular flagellum was found growing in place of the left eye. Mechanical stimulation of the heteromorphic flagellum evoked behavioral responses

similar to those caused by stimulating the normal ipsilateral outer antennular flagellum. The ipsilateral behavioral responses evoked by either the normal or regenerated flagellum were readily distinguished from the bilateral reflexes caused by stimulation of the remaining eyestalk.

Electrical recordings from muscles of the second and third antennular segments indicate that stimulation of the normal and the regenerated flagellae cause similar changes in antennular muscular activity and these differ from responses evoked by eyestalk stimulation.

Intracellular recordings were obtained from 10 units in the supra-oesophageal ganglion while electrically stimulating and recording from the antennular nerves. The regenerated flagellum was also stimulated electrically. Four units responded to stimulation of the regenerated flagellum as well as to the antennular nerves. One of these units was a motor element in the ipsilateral antennular nerve and had a complex discharge pattern similar to that in the antennular nerve and muscle. The sequence of intracellular potential changes was similar whether the response was evoked by stimulation of the ipsilateral antennular nerve or of the regenerated flagellum. The central functional connections of sensory nerves from a heteromorphic appendage may therefore be determined by the nature of the sensory endings rather than by the location of the appendage. (Supported by U.S.-P.H.S. grants B-3271 and B-1624 and grant-in-aid to M.J.C. from Bermuda Biological Station. R.B.S., N.F.S. Undergraduate Research Participant.)

160

ALBERT H. MEIER and W. R. FLEMING, University of Missouri. Effects of pitocin and pitressin on water and sodium fluxes in the plains killifish, *Fundulus kansae*. (15 min.)

The effect of pitocin and pitressin injections (0.10 I.U./gm) on sodium and water fluxes has been studied. The influx of water into female *F. kansae* held in tap water, as measured by the weight increase of renal papilla ligated fish, is reduced by pitocin. Pitocin also reduces the outflux of water from fish held in 0.20 M NaCl. Comparable doses of pitressin are ineffective; however, large doses also reduce water influx.

Pitocin and pitressin both increase the uptake of sodium by fish held in tap water.

By tying off the anus, renal papilla, or both, sodium loss may be restricted to the gill or to combinations of gill and kidney or gill and gut. Studies utilizing such ties suggest that normally about 65% of the sodium loss is through the gill, 25% through the kidney, and 10% through the gut. Pitocin decreases sodium loss through the gill about 50% at one hour post-injection. Pitressin had no effect on the gill, and neither hormone had any effect on renal sodium loss. Both hormones increased sodium loss through the gut about 500% from 1 to 28 hours post-injection.

92

CHARLES B. METZ and HERBERT SCHUEL, Oceanographic Institute, Florida State University. Inhibition of agglutinability and fertilizing capacity of sea urchin sperm by papain-digested antibody. (15 min.)

Several lines of evidence show that the initial events of fertilization involve the interaction of surface substances of the sperm and egg. These include the demonstration (Tyler, 1945) that treatment with non-agglutinating (photo-oxidized) antiserum markedly reduces the fertilizing capacity of sperm.

In the present investigation anti-*Arbacia*-sperm rabbit sera were rendered univalent (non-agglutinating) by papain digestion (Porter, 1958), poisoned with iodoacetamide to prevent reoxidation to the multivalent form and finally dialyzed against sea water. Treatment of *Arbacia* sperm with such univalent antisera failed to block agglutination by undigested, multivalent antibody. Nevertheless, several experiments show that the univalent antibody combines with the sperm surface. Thus, sperm pretreated with univalent anti-sperm rabbit serum agglutinated strongly and fluoresced on addition of fluorescein conjugated anti-rabbit-globulin sheep serum.

Pretreatment of sperm with univalent anti-*Arbacia*-sperm rabbit serum was examined for effect on fertilizin agglutination. Serum from one rabbit strongly blocked fertilizin agglutination of sperm. Serum prepared in a second rabbit failed to block fertilizin agglutination. Pretreatment of sperm with either of these sera markedly reduced the fertilizing capacity of the sperm. Absorption of univalent anti-*Arbacia*-sperm serum with *Lytechinus*, but not with *Echinarachnius*, sperm removed the fertilization inhibiting action for *Arbacia* sperm.

Tests for neutralization of the fertilization inhibiting action of univalent antibody by sperm extracts have so far failed to give consistent results. (Supported by grants from the N.S.F. and the U.S.P.H.S.)

108

HERMANN MEYER, Colorado State University. Cranio-encephalic morphology of the Wyoming Ground Squirrel, *Citellus richardsonii*. (10 min.)

The brain of *Citellus richardsonii* and its spatial relationship to the cranial cavity were studied by gross section series of the entire head, by macroscopic sections of the brain in three planes and by submacroscopic dissections under a dissection microscope by the method of Klingler (Klingler, Schweiz. Arch. Neurol., 36: 247, 1935).

The brain is of the macrosmatic, lissencephalic type. It measures about 30 mm in length, 20 mm at its widest part, and 12 mm in dorsoventral direction. Color slides will be shown to demonstrate the major structures and their relationship.

The present preliminary account is part of the morphological complement of a physiological study on hibernation at Colorado State University. Histological studies on the brain of *Citellus richardsonii* are in progress. (Supported by grant G-18665 from the N.S.F.)

41

HERMANN MEYER, Colorado State University. Use of I.B.M. cards for custom-made bibliographic punch card systems.

Custom-made punch card systems for filing bibliographical references have distinct advantages over using standard cards which require time consuming numerical coding. The commercially available custom-made cards, however, are relatively expensive.

Comparatively inexpensive custom-made cards were prepared for personal use by punching double rows of marginal holes in blank I.B.M. cards.

Only every second possible location for a hole was punched to allow space for selfexplanatory symbols between adjacent holes. One of these cards was used as a master on which the symbols were inserted with India ink by means of a lettering guide. The desired number of punch cards was then printed by the photo-offset method on an offset press with close register. The cost for blank cards, punching and printing was about one fifth of similar commercially available custom-made bibliographical tools.

212

EDWIN A. MIRAND, Roswell Park Memorial Institute, Buffalo. Further evidence that the spleen is necessary to produce the erythropoietic syndrome in Friend Virus Disease.

Friend virus infections in HA/ICR Swiss mice and DBA/1 mice produces a syndrome characterized by a malignant disorder involving uncontrolled proliferation of reticulum cells with massive involvement of the spleen and liver, and a non-malignant response of the hematopoietic system manifesting itself by an increased production of erythroblasts, erythrocytes and leucocytes. Mirand, *et al* (1960-61) demonstrated the importance of the spleen in producing the erythropoietic syndrome in Friend virus-infected mice as judged by splenic Fe^{59} uptake and splenectomy. To support this viewpoint further, splenectomized DBA/1 mice bearing normal isologous and autologous subcutaneous splenic transplants were able to restore the erythropoietic syndrome when receiving virus shortly after transplantation. On first transplantation, these normal splenic transplants developed readily into solid tumors, composed of large undifferentiated mononuclear cells. To date, these splenic tumors have been transplantable serially to 100% of DBA/1 mice through seven generations, and have contained virus titering to 10^{-3}-10^{-4}. After the second transplantable generation, the tumor transplants were not able to induce the erythropoietic syndrome in splenectomized DBA/1 mice, but did produce generalized reticulum cell leukemia.

These studies demonstrate: 1. the ability of the virus to transform readily normal splenic transplants to reticulum cell tumors which are transplantable serially, and 2. the ability of splenic transplants to restore the erythropoietic syndrome in splenectomized mice with Friend Disease. (Supported by grants from the U.S.P.H.S. and the Hartford Foundation.)

87

JOHN B. MORRILL, Wesleyan University. Electrophoretic separation of some soluble hydrolytic enzymes in the development of *Ilyanassa obsoleta*. (15 min.)

In a study on protein differentiation during the development of *Ilyanassa* several hydrolytic enzymes were resolved by the zymogram method of Hunter and Markert ('57). Extracts were prepared of eggs and of 1- to 10-day embryos and larvae reared at 18-20°C. Packed eggs, embryos, or larvae were homogenized, frozen and thawed three times, and centrifuged at 10,000 g for 3 minutes. Five to 10 microliters of the supernatants were subjected to starch gel electrophoresis (borate buffer, 0.023 M, pH 8.6).

Twenty-three electrophoretically mobile bands were developed. Several bands were developed with two different substrates. Seven bands occurred with extracts of all developmental stages and included four esterase (i.e., split alpha-naphthyl acetate), one aminopeptidase, one alpha-glucosidase and one dopa oxidase. Three additional bands—one esterase, one acid phosphatase and one beta-glucuronidase—were limited to 0- to 4-day embryos. Thirteen other bands were obtained with extracts of 4- to 10-day embryos and larvae. These bands first appeared as follows: three acid phosphatase and one aminopeptidase on the 4th day; one beta-glucuronidase on the 5th day; one esterase and one acid phosphatase on the 6th day; two esterase, one alkaline phosphatase and one lipase on the 7th day; one eserine-sulfate-inhibited esterase and one sulfatase on the 8th day. Developmental changes in the enzyme patterns probably are associated with the utilization of the yolk and with organogenesis which begins about the 4th day. The localization of these enzymes in the egg, embryo and larva has yet to be determined. (Supported by N.S.F. grant G-10893.)

52

FR. JAMES MULLIGAN, S.J., University of California, Berkeley. Physical structure of the song of the Song Sparrow. (15 min.)

Tape recordings were made in the field of the voice of several different subspecies of the Song Sparrow which occur in the San Francisco Bay area. About two thousand songs from more than a hundred individuals were recorded and analyzed by means of the sound spectrograph and an oscillograph. The relative advantages of these two methods of analysis in the study of this species are discussed. It was found that in the details of physical structure tremendous variety exists within these populations, and it is rare to find identical songs or parts of songs in two birds. This same variability holds for the repertoire of a single individual. By classifying the graphically displayed sounds according to similarity of structure, a tentative description of the song of the local representatives of this species was derived and an attempt is made to identify some species-specific characteristics.

109

EDWARD M. NELSON, School of Medicine, University of Puerto Rico. An adaptation for snapping in belonid fishes. (15 min.)

The belonid genera *Strongylurus* and *Tylosurus* exhibit in their jaw apparatus a number of specializations which adapt the jaws for snapping up prey.

1) Both jaws are elongated so that the head is about one-third of the standard body length. 2) The parts of the upper and lower jaws are strengthened into solid, single units by a) firm syndesmoses of the component bones and b) median series of interdigitating "knuckles." 3) The jaw suspension has strut-like thickenings along lines of stresses. 4) A single row of long, sharply pointed teeth is fixed in each quadrant of the jaws. When the jaws are closed, the rows of the upper jaw fit into appropriate grooves in the lower jaw while those of the lower jaw lie just laterad the upper jaw. 5) The closing musculature is very strong and is attached to the lower jaw through well-developed sesamoid articular bones. The point of attachment is close to the axis of movement to obtain the maximum speed of movement. 6) The quadrato-mandibular joint

is shaped to restrict movement to a single axis. (In teleosts generally, this joint is of the saddle type affording simultaneous movements about two axes.) 7) A linkage of three axes, two fixed and one moving, is present including a) maxillo-palatine (fixed), b) quadrato-mandibular (fixed) and c) maxillo-mandibular (moving).

By virtue of these specializations, the upper and lower jaws both move to about 55°. They snap rapidly and forcefully together transfixing the prey with the teeth. (Supported in part by grant NSF-G14718 of the National Science Foundation.)

119

RONALD R. NOVALES, Northwestern University. The role of ionic factors in hormone action on the vertebrate melanophore. (30 min.)

The vertebrate melanophore is well suited for studies in cellular endocrinology. Furthermore, such studies may have broad implications, since corticotropin possesses intrinsic melanophore-stimulating activity and several groups of agents act on both melanophores and neurons. Thus, studies on melanophores may shed light on problems in adrenocortical and nerve physiology and the converse. For example, it is reasonable to assume that acetylcholine produces melanin dispersion in teleost fish melanophores by increasing the sodium permeability of the cell membrane, followed by some kind of mechanico-excitation coupling process and cytoplasmic solation, as previously established.

Melanocyte-stimulating hormone (MSH) may produce melanin dispersion in a similar fashion and recent data have been obtained bearing on this view. There is a highly specific sodium requirement for MSH action on the frog skin melanophore and sodium is probably involved in the primary action of the hormone on the cell. Calcium ion may be involved in maintenance of a low sodium permeability concentration, since there is a heightened melanophore response to MSH in a calcium-free medium. The tissue cultured amphibian melanophore responds to natural or synthetic MSH by cellular expansion and melanin dispersion. This response is sodium dependent. Agents such as epinephrine or pineal melatonin produce contraction of the cultured melanophore and since melanophore contraction occurs readily in sodium-free media, these agents may produce their effect by enhancing sodium extrusion from the cell. These interpretations may provide the basis for a unified view of hormonal action on a target cell. (Supported by Grant G-9019 from the N.S.F. and the Graduate School, Northwestern University.)

66

J. R. NURSALL, University of Alberta. Swimming and the origin of paired appendages. (25 min.)

Locomotion in fishes is provided by lateral undulation of the body producing thrust, as described by Gray (J. Exp. Biol. 10(1 and 4), 1933). The folding of a myomere allows short, quick-acting muscle fibres to exert their effect smoothly over a distance of several segments. The phylogeny of myomere specialization is followed through several groups, from protochordates to teleosts. Teleosts show several variations of the basic plan. Myomere, body and caudal fin form are all directly related to one another and to swimming ability in all fish-like chordates. The most extreme specialization for swift and continuous swimming occurs among scombroids.

Experimental work with lampreys, trout and frog tadpoles suggests that a constant rate of speed of swimming is not possible for fish-like chordates.

It is not possible to discuss swimming just in morphological and mechanical terms. Swimming is a whole-body reaction to a relatively dense ambient medium. Therefore it will be necessary to attempt to analyze the proprioceptive control of swimming and the input of environmental information that governs it.

The concept of a primordial fin fold is not well-supported by palaeontological, morphological or experimental evidence. Paired appendages arose because of evolutionarily specific requirements; descendent homologues have been further specifically modified.

The swimming of certain mammals is briefly examined; mode and mechanism are compared to those of fish. The problems of power development in all aquatic chordates are discussed.

93

E. F. OAKBERG and EVELYN CLARK, Oak Ridge National Laboratory. Meiotic prophase stage and species differences in radiation response of the mammalian primary oocyte. (15 min.)

Fifty r destroys all the early oocyte stages of the mouse. As a result, permanent sterility occurs after the more mature, radio-resistant oocytes have been utilized. The mouse has been considered atypical, since early oocyte stages are not destroyed in guinea pigs (Genther, Am. J. Anat., 55: 1, 1934) or monkeys (Van Eck-Vermande, Fertil. and Steril., 10: 190, 1959), and fertility appears normal after exposures of several hundred r both in women (Peck *et al.*, Radiol., 34: 176, 1940) and in dogs (Andersen and Schultz, Rad. Res., 12: 417, 1960). In a study of the physical bases for the above differences, we have given female guinea pigs 200 r, and compared postirradiation changes with those induced in mice by 50 r. A marked difference, with survival of many early oocytes in the guinea pig, has been obtained. Normally, in mammals, the definitive number of oocytes is formed before birth, development of the oocytes then being arrested until growth of the follicles occurs. We have found that this arrest, however, occurs at a much earlier meiotic prophase stage in the guinea pig than in the mouse. Thus the species difference in radiation sensitivity may be accounted for on the basis of cell stage. Furthermore, the argument used by some authors that the presence of early prophase stages indicates continued formation of oocytes from the germinal epithelium clearly is not valid if oocytes can be arrested in these stages of development.

213

ROBERT ORTMAN, Boston College. A note on the cytology of the pituitary of *Gadus morrhua*.

After sublimate-formol fixation and staining by Crossmon's (1937) modification of Mallory's stain, two tinctorial types of acidophils have been found in the anterior lobe of the dog (Purves and Griesbach, 1957), wallaby (Ortman and Griesbach, 1958) and frog (Ortman, 1960). Codfish pituitaries were studied chiefly to see if this same fixation and staining method, adjusted to the gland in

question, would demonstrate two kinds of acidophils. Further, the possible effect of various fixatives was investigated.

Codfish were collected alive off the coast of Newfoundland, and sacrificed immediately after capture. Pituitaries were treated with the following fixatives: sublimate-formol (Copeland's fluid), modified Bouin with trichloroacetic acid (Halmi's fluid), Bouin and Zenker. Paraffin sections were prepared in the frontal plane. The terminology of the regions of this pituitary follows that set forth by Pickford and Atz (1957).

The majority of the parenchymal cells of the proadenohypophysis stain dull purple but certain cells located at the border between the pro- and meso-adenohypophysis stain a vivid red-purple. These latter cells appear to belong to the proadenohypophysis and not to the next adjacent region.

Only one type of acidophil is present in the mesoadenohypophysis (Übergangsteil); this cell generally stains red. Although basophils sometimes stain blue or dull purple, there is not sufficient evidence that these really represent separate tinctorial cell types. The cells of the metaadenohypophysis (pars intermedia) are generally cyanophilic. (Supported by grant A-759 from the National Research Council of Canada.)

151

ROBERT ORTMAN and KEVIN FALLON, Boston College. Localization of acid and alkaline phosphatase in the pituitary of *Rana catesbeiana* and *Rana pipiens*. (15 min.)

Thin cryostat-frozen sections of pituitaries of both sexes of bullfrogs and leopard frogs have been studied. Cold 10% formalin (pH 6.7 to 7.0) fixation was used for alkaline phosphatase studies and for acid phosphatase determinations in the bullfrog. Cold acetone fixation or postfixation of fresh frozen sections was required for satisfactory localizations of acid phosphatase in the pituitary of leopard frogs.

The substrate for the phosphatases was sodium alpha naphthyl phosphate. Simultaneous azo dye coupling methods were carried out with the diazotate of 5-chloro-O-toluidine for alkaline phosphatase and with the diazotate of 4-amino-3,4-dimethyl azobenzene for acid phosphatase.

Alkaline phosphatase activity is present in the pituitary of the leopard frog in the capsule and in endothelial cells of the blood vessels of the gland. In the bullfrog pituitary, alkaline phosphatase activity is present in the glandular capsule and the region of the cell membranes of all chromophils (acidophils and basophils). The entire surface area of the cell appears to contain the activity. All enzyme activity is abolished in controls incubated in the presence of KCN.

Acid phosphatase activity is present in the same locations in both species *viz.*, in the cytoplasm of all parenchymal cells in anterior and intermediate lobes and in the substance of the pars nervosa between pituicytes. All enzyme activity is abolished in controls incubated in the presence of NaF. (Supported by grant A-3926 from the U.S.P.H.S.)

114

WILLIAM B. OWEN, University of Wyoming. The contact chemoreceptors of the mosquito, *Culiseta inornata* (Williston), and their role in feeding. (Introduced by L. Floyd Clarke) (15 min.)

All the taste organs of the mosquito which have been definitely identified are chemosensory hairs. These sensilla are located on the tarsi, labella and ligula. Within the buccal area (cibarial pump) are similar structures which appear to be gustatory in function. Appropriate stimulation of each group of receptors elicits more than one type of behavioral response. In an attached mosquito, aspiration of fluids is mediated by any of the groups of receptors when stimulated separately. The special techniques used will be described and some information given on the physiology of these taste organs. (Supported by grant E-931 from the U.S.P.H.S.)

140

CLARE PEARSON and JERRY J. KOLLROS, State University of Iowa. Spinal cord response to amputation of the hind limb in larval *Pseudacris*. (15 min.)

Pseudacris nigrita tadpoles had one hind limb removed at stages IV+ through IX−. In group A, 12 animals were sacrificed after 31-79 hours, and individual animals after 5-7 days. In group B the regenerate was removed 5 days after the initial operation, and animals were fixed 2 days later. Lateral motor column cells were observed. On the operated side in group A there were uniformly fewer cells than on the control side. This finding generally confirms the brief report of Hughes and Lewis ('61) on the immediate postoperative period in *Xenopus*. In group B, in contrast, cell numbers on the operated sides were greater than on control sides, precisely as reported earlier from this laboratory in *Rana pipiens* (Beaudoin, '55; Kollros and Race, '60), and *Xenopus* (Baird, '57), from 5 days postoperatively to stage XIII. Hughes and Lewis report similar findings. In group A, both lateral motor columns show cell degeneration, more so on the normal than on the operated side. In group B, cell counts confirm that cell degeneration on the operated side has stopped or been retarded, whereas such degeneration has continued on the control side. Possible migration of cells into the lateral column from the mantle layer cannot be discounted, but the present studies do not support the contention of Hughes and Lewis that the larval motor column has a continuous turnover of cells, so that the definitive number represents but 11-13% of the total number of cells present during the developmental period. (Supported by grant A-2202 from the U.S.P.H.S.)

158

JAMES C. PERRY, NANCY B. PERRY, JOHN G. SURAK and PETER SANFELIPPO, Marquette University. Recent advances in the study of induced polyarteritis nodosa. (Introduced by Paul A. Wright.) (15 min.)

Investigations during the past several years have established the effectiveness of estrogen and follicle stimulating hormone (FSH) in inducing polyarteritis in rats when employed according to the method of Perry (J. C. Perry and N. B. Perry, Arthr. and Rheum., 1:244, 1958).

That the induced disease was not due to specific actions of either of the hormones employed either singly or collectively is borne out by the results obtained from substituting a variety of stress-inducing agents for the originally employed hormones. Polyarteritis has developed following the use of 10% formalin and FSH within the same

length of time after treatment and with the same characteristic responses as obtained with estrogen and FSH. Pituitary hyperplasia and adrenal adenomata were associated with typical fibrinoid necrosis and nodular enlargements of numerous arteries. Thyroid stimulating hormone (TSH) and growth hormone (STH) have been substituted for FSH following estrogenic treatment. Again the resulting polyarteritic responses were identical with those originally obtained. When diethylstilbesterol or thyroxin were substituted for estrogen and followed by treatment with either FSH, TSH or STH, polyarteritis developed as in the above instances. Severe polyarteritis was obtained with all these procedures in at least 50% of treated animals, whereas it did not appear in any of the appropriate controls.

These results point to a common mode of action exerted by the inducing agents employed which results in an abnormally stressful interaction between the pituitary and adrenal glands. (Supported by Grant C-4504 and C-4504(C1) from the U.S.P.H.S.)

161

E. W. PFEIFFER and H. A. BRAUN, Montana State University and Western Montana Clinic, Missoula. The effects of vasopressin on urine concentration of a mammal with few long loops of Henle and of a mammal with many long loops. (15 min.)

The primitive rodent, *Aplodontia rufa,* and domestic rabbits were given vasopressin injections during water diuresis. The vasopressin-injected *Aplodontia* produced urine with an average osmolal concentration about 1.5 times that of the plasma in those animals receiving the largest dose. Rabbits injected with equivalent doses of vasopressin achieved an average urine/plasma osmolal ratio of 3.5. These results are in accord with predictions based upon the countercurrent hypothesis as it relates to relative length of medullary nephron loops and ability to concentrate urine; *Aplodontia* has few long loops of Henle and a relatively small renal medulla while the rabbit has many long loops and a relatively large renal medulla. (Supported by grant 658-3 from the Montana Heart Association.)

132

AUSTIN PHELPS, University of Texas. Studies on factors influencing heat survival of a ciliate, a mite, and an ostracod, obtained from a thermal stream. (10 min.)

A thermophilic strain of the ciliate, *Tetrahymena pyriformis,* has been obtained in axenic culture from a thermal stream which originates from Mimbres Hot Springs in S. W. New Mexico. It will grow at 41.2°C, whereas thermophilic strains obtained by the author from other thermal sources have not been made to grow above 40.0°C. This strain, unlike others, can be acclimated to high temperature in the laboratory.

The mite, *Thermocarus nevadiensis,* has been found in abundance at Mimbres. It is found in water as hot as 50°C, but experiments show that it can survive this temperature for only a few hours. Unlike a strain of *T. nevadiensis* from Oregon, whose characteristics have recently been described, this strain is not an obligate thermophil, but can live for three months at 22°C, and for over a month at 6°C.

An ostracod is also found in considerable quantity in this stream. It occurs between 43°C and 47°C, but survives at 50°C. As in the case of *T. pyriformis* and of *T. nevadiensis,* survival as a function of temperature and time of exposure will be shown. (Supported by N.S.F. grant G-71896 and, in part, by N.S.F. grant G-13160, the latter issued to Dr. Howard T. Odum.)

214

LAJOS PIKÓ, California Institute of Technology. Fertilization in the Chinese hamster after normal matings.

The Chinese hamster has several unique features as a laboratory animal (Yerganian, J. Nat. Cancer Inst. 20, 705, 1958). Data on its reproductive physiology, however, are lacking.

Our stock, originally obtained from G. Yerganian, has been maintained on an artificial day-night schedule with 14 hours light and 10 hours darkness. Estrous females were selected by vaginal inspection and added to the males one hour after the beginning of the dark period. Mating usually took place in 1–2 hours. Ovulation occurs some 6–7 hours later (last 2 hours of darkness). The females were sacrificed at different intervals for the study of sperm transport, ovulation, sperm penetration, pronuclear development and cleavage (by phase microscopy).

Thirty-three females furnished 231 eggs. The eggs are at metaphase II when ovulated. Sperm are not usually found in the ampullae at the time of ovulation.

The eggs are penetrated 2–4 hours after ovulation in the lower part of the ampulla. In most eggs the tail of the fertilizing sperm remains in the perivitelline space. Only 6% of the eggs contained a sperm tail in the cytoplasm while in about 20% the sperm tail remained entirely outside the egg. An unaltered "supplementary" sperm occurred in the perivitelline space of 3% of the eggs. Dispermy was clearly identified in two out of 55 undivided eggs.

The approximate times of the first 3 cleavages are: 1st, 24 h; 2nd, 54 h; and 3rd, 74 h after the average time of sperm penetration. The two latter cleavages take place in the isthmus of the Fallopian tube. (Suppored by a grant from the Lalor Foundation.)

215

LAJOS PIKÓ, California Institute of Technology. Repeated fertilization of fertilized rat eggs after treatment with versene (EDTA).

Tyler and Schultz (1932) were the first to show in *Urechis caupo* that repeated fertilization was possible. More recently, demembranated sea urchin eggs could be refertilized even at the 2-cell stage particularly if exposed to Ca- and Mg-free media (Tyler *et al.,* Biol. Bull. 110, 184, 1956).

In mammals, there is no good evidence of repeated fertilization in spite of the natural occurrence, in several species, of "supplementary spermatozoa" in the perivitelline space. We find, however, that versene treatment can provoke a later penetration into the vitellus of these spermatozoa.

Sherman rats were mated towards the end of estrus. The right tube was exteriorized under Nembutal narcosis 2½–3 hours after mating and 1 μl of 1:500 M versene was injected into the ampulla; the left side served as control. The

females were sacrificed 20–50 hours later and the eggs examined by phase microscopy before and after acetocarmine staining.

Of 399 eggs from 38 females, most were fertilized and developed normally on both sides. The incidence of "typical" dispermy (simultaneous penetration of 2 sperm into the cytoplasm) was unchanged (2.8% exp.; 4% control). But the number of eggs with supplementary spermatozoa increased two-fold on the treated side (46.2% vs. 22.6%; $P<0.001$) and ⅓ of such eggs contained in their cytoplasm spermatozoa of a secondary penetration. The refertilizing sperm head either developed into an extra nucleus or, more often, degenerated and showed up as a darkly staining mass up to the time of 2nd cleavage. Judging from the appearance of the sperm, refertilization occurred at various times up to the first cleavage. (Supported by a grant from the Lalor Foundation.)

216

DOROTHY PRICE and JAN MARTAN, University of Chicago and University of Oregon. The supracaudal gland of the female guinea pig.

Recent studies (Martan, Jour. Morphol., in press) have shown that the supracaudal glands of male guinea pigs are composed of aggregations of sebaceous glands which open into hair follicles in a circumscribed area of the supracaudal region. The sebum, which is abundant in intact adult males, is waxy and has a characteristic pungent odor. Castration of adult males results in reduction in gross size of the gland and profound regression histologically. The sebum is dry, scanty and odorless. Injection of such castrates with 2.5 mg of testosterone propionate daily restores the supracaudal gland to its normal size and secretory activity. Following castration of newborn males, growth of the supracaudal gland is slow and very limited; the sebaceous acini resemble those of the general body skin. Sebum is dry and without odor.

In adult females, the supracaudal gland is small and has only 2 to 4 small sebaceous acini as compared with 10 to 15 large acini in the glands of adult males. There is usually only a small amount of dry, odorless sebum. When adult females are injected with testosterone propionate (2.5 mg daily) the supracaudal glands enlarge, sebum becomes waxy, and the pungent odor is detectable within a period of two weeks. Histologically, the glands of androgen-injected females strikingly resemble those of adult males. However, a comparison of the results of hormone treatment of adult females and adult castrated males indicates that the female supracaudal gland is less responsive to androgen than that of males. (Supported by RG-2912 and RG-5335 from the U.S.P.H.S.)

48

HOWARD M. REISMAN, University of California, Los Angeles. The reproductive behavior of the five-spined stickleback, *Eucalia inconstans* (Kirtland).

Reproductive behavior can be induced pre- and post-seasonally with the application of those environmental conditions that the fish normally encounters in nature during the spring, viz., 16-hour photoperiod, low permissive temperatures (16 degrees C), available food supply, and adequate nest-building material. High temperatures (exceeding 20 degrees C), sub-optimal photoperiod, crowding, and the absence of nest-building material tend to prevent the onset of reproductive behavior.

Although high temperatures prevent reproductive territoriality, they do not inhibit the defense of an area for feeding purposes. In connection with territorial interaction, a unique lateral display is observed.

The mating behavior is subject to variation due to differences in the mating tendencies of one or both of the mating partners. However, except for the absence of a pre-spawning mating dance, many of the behavioral patterns which are common to the stickleback family have been observed in this species.

Eucalia demonstrates a remarkable capacity to substitute successfully artificial nest materials, in this case, differently colored threads of wool yarn, when natural materials are absent. The presence of females is not necessary to induce nest-building activity in the male if all the other conditions essential for this activity are present. However, when females are absent or when a male's mating drive is thwarted, he will demonstrate an increased frequency of nest-building. In addition, a sympathetic induction of nest-building is observed where the perception of one male building stimulates other males within visual range to initiate nest-building activity.

217

OLIN RULON, Northwestern University. Cobalt and versene in the extension of fertilizability in sand dollar eggs.

The loss of fertilizability in ova of *Dendraster excentricus* is usually complete by two days after they are removed from ripe ovaries and maintained in covered fingerbowls at 18°C. Cobaltous chloride has been found to increase the length of fertilizable life in these eggs. Combination solutions of cobaltous chloride and sulfhydril compounds have extended the fertile life to as much as 25 days. In the present work cobaltous chloride (M/400-M/800) alone extended fertilizability in 50-80% of the eggs to 6 days. When the chelating agent, versene, was added to the cobalt solution its effectiveness was greatly enhanced although versene alone in the concentration used was without effect. The best combination (50 cm^3 M/200 cobaltous chloride plus 50 cm^3 0.05% versene) prolonged the fertilizable life in 30% of the eggs to 20 days.

The work suggests that cobalt and cobaltous-versene prevent the deterioration of fertilizability by preventing destructive oxidations at the egg surface.

51

H. C. SABELLI and J. E. P. TOMAN, Chicago Medical School. Autonomic-like mechanisms modulating brain functions. (15 min.)

We have studied the effects of a series of autonomic and psychotropic agents in an effort to define patterns of central action in experimental animals. Behavioral, electrographic and chemical and electrical seizure methods were used. Results will be presented relevant to the following hypotheses: a.) adrenergic and muscarinic systems synergistically modulate seizure susceptibility; b.) behavioral interactions between adrenergic and cholinergic agents do not parallel their interactions on electrographic or seizure effects; c.) nicotine

reverses some central effects of amphetamine-like agents; d.) blockade or saturation of a single modulator system may give behavioral effects only at the expense of undesirable side effects; e.) psychotropic drugs may selectively induce behavioral changes with a minimum of neurological and peripheral effects through a suitable pattern of multiple central modulator actions; f.) tranquilizers may block certain central inhibitory systems while stimulants facilitate central inhibition. (Supported by grant MY-5503 from the U.S.P.H.S., and Consejo Nacional de Investigaciones (Argentina).

218

MURIEL I. SANDEEN, Duke University. The influences of eyestalk removal and nervous system extracts on the motor activity of the fiddler crab, *Uca pugilator.*

Motor activity of eyestalkless fiddler crabs was measured using an actograph of the tilting chamber variety. Seven animals, one group, were studied simultaneously. Group 1 animals were followed for 8 days and Groups 2 and 3 for 3½ days. The daily total activity decreased gradually, and for the first two or three days major peaks of activity were obtained in many cases. For the 24 hr. period beginning 12 hours after destalking Group 1 showed an average total activity of 245 units, for the second 24 hr. period, 152 units, and for the third, 108 units. For four subsequent days the average total activity values were: 103, 109, 141 and 115. Average total activity values for Groups 2 and 3 showed similar losses in activity, 33 and 32% on the second day and 54 and 52% on the third day. The average total activity of a 4th group measured for a 24 hr. period 90 hours after eyestalk removal was 112, 54% of normal controls. Animals which had only one eyestalk removed for 9 days did not show a comparable reduction in total daily activity nor a loss of major bursts of activity.

When sea water was injected into 131 eyestalkless individuals 75% showed an increase in activity in the first hour. Similarly, of 63 individuals receiving boiled extracts of circumesophageal connectives 73% showed an increase in activity. In contrast, increased activity occurred in only 56% of 36 individuals receiving eyestalk extract, 56% of 50 individuals receiving thoracic cord extract and 57% of 42 animals receiving extracts of brain. An inhibitory action of these latter three extracts is suggested. (Supported by grant B-2324 from the U.S.P.H.S.)

68

D.B.O. SAVILE, Plant Research Institute, Ottawa, Canada. Gliding and flight in vertebrates. (25 min.)

In flying fishes gliding is powered by kinetic energy of the body developed in normal swimming and supplemented by tail action after the body leaves the water. In all other vertebrates gliding is derived through parachuting, from downward jumping, gravity supplying the energy for forward motion. All true flight has evidently developed from the latter sequence. An adequate nervous system is the one absolute requirement for parachuting and must supplement morphological changes in gliding and flight. Parachuting animals must preserve their normal attitude in descent; and in gliding and flying a short reaction time is vital for steering, etc. In pterosaurs and birds the tail shortened progressively as improved nervous systems allowed sacrifice of stability for increased maneuverability. Flight supremacy in birds stems largely from evolution of the feather. Physically feathers have great resilience, graded flexibility and lightness. Aerodynamically they provide smoothed contours and streamlined sections; permit the development of slotted wings for high lift; and, by differential porosity, allow the attainment of laminar flow, with consequent marked reduction of drag. Although our qualitative understanding of bird flight is now nearly adequate, the quantitative solutions to many problems still seem remote; and this deficiency hinders the work of evolutionists, taxonomists, ecologists and physiologists. We cannot yet measure power consumption; nor can we fully analyze the causes and complex results of changes in wing length or area. A concerted interdisciplinary attack on these problems is overdue.

81

M. W. SCHEIN, Pennsylvania State University. Hallucinatory behavior in chickens evoked by brain stimulation. (Motion picture, 15 min.)

Hallucinatory behavior is occasionally evoked by electrical impulses delivered to specific areas in the brain of unanesthetized free-roaming chickens. The bird responds to a fixed point in the environment as if something were there. In the accompanying film, the bird during stimulation shows both attack and strong avoidance behavior to a point in space about 3 inches to her right, with no carry-over after termination of shock. Impulses were delivered in the vicinity of the hypothalamus, 9 mm below the dorsal forebrain surface via stainless steel electrodes, AWG 36, insulated except at the tip, using a carrier adapted from that described by Von Holst (Naturwissenschaften, 18:1960). Shock parameters: 0.1 ma; 50 pulses/sec. square wave; 4.0 millisec pulse duration; 5.0 sec. shock duration. Electrode locations 1 mm or more above or below the hallucinatory point evoked qualitatively different behavior.

85

LESTER C. SHELL, University of Dubuque. Distribution of sulfhydryl groups in development. (15 min.)

The distribution of sulfhydryl groups in the cellular components of the cleidoic grasshopper egg, *Melanoplus differentialis,* was studied. The increment of these chemical groups during embryogenesis was determined using silver nitrate as a titrating agent by amperometric methods.

Sulfhydryl groups can react by oxidation to form the disulfide group (-S-S-), or they can combine by hydrogen bonding. Therefore, it is customary to speak of free sulfhydryl and bound sulfhydryl groups. In order to study the bound groups of the egg, such reagents as guanidine hydrochloride, Dupinol P.C., and urea were used to exert a sort of physical swelling to free the sulfhydryl groups hydrogen bound; and to break disulfide linkages, a powerful reducing agent, sodium borohydride was used. Cellular components were separated by means of a refrigerated centrifuge and titration was with 5×10^{-4} M solution of silver nitrate. The chelating agent, ethylene diamine tetracetic acid was used to prevent metal catalyzed oxidation of soluble non-protein mercaptans.

The first titration was for the free sulfhydryl groups in each cellular component. Cellular components were treated to break hydrogen bonds and disulfide linkages, then titrated in the same manner as for the free sulfhydryl groups.

The greatest concentration of sulfhydryl groups was found to be in the microsome portion of the grasshopper egg; this is in accord with other work which indicated that these sub-cellular particles are sites of biosynthesis. The mitochondria, or large particles, had next greatest concentration of the sulfhydryl groups. A noted increase of these groups during embryogenesis has been associated with the period of active growth and differentiation in these organisms. (Supported in part by a U.S.P.H.S. grant to J. H. Bodine, State University of Iowa.)

167

JOHN G. SINCLAIR, Medical Branch, University of Texas. Collection and study of early cetacean embryos. (Introduced by Raymond Blount.) (15 min.)

Scarcity of available early cetacean embryos led to a five months trip to Japan where dolphins are hunted as food animals. The Whales Research Institute and University of Tokyo both have limited materials prepared for study. In December one catch of 300 yielded one embryo 4.2 mm long, aged one month. A second drive in January (unusual) yielded one embryo from 600 dolphins. This was two months old, 26 mm length. Both are of predicted age based on assumed impregnation period in October-November. They also indicate a very low reproductive rate for the dolphin. The dominant species is *Prodelphineus ceruleoalbus*. Like the American *Tursiops truncatus* this species has contributed valuable data on the structure of cranial and autonomic ganglia of the head. A new pair of tentorial ganglia are described at this time from series of a 37-mm whale embryo. (This was supported by a Navy Contract, NONR – 3355(00).)

219

JAMES G. SNEDECOR, GEORGE E. GHAREEB and DAVID B. KING, University of Massachusetts. *In vitro* studies of chick glycogen body.

Glycogen bodies were removed from week old chicks and shaken in phosphate buffer at 39° for one hour. Glycogen determinations were made on the glycogen bodies and the media. The media were also analyzed for glucose and in some cases for lactic acid. The total amount of glycogen recovered from each flask was equivalent to that obtainable from unincubated glycogen bodies, indicating little glycogenolysis. Approximately 30% of the recovered glycogen was present in the medium and 70% remained in the glycogen body. Very small amounts of glucose and lactic acid were recovered from the media. The addition of insulin or epinephrine to the media did not alter the results significantly, nor did gassing with 100% oxygen or nitrogen. Leakage of glycogen into the medium increased with increased shaking rate, but glycogenolysis was unaffected.

In other experiments, the level of active phosphorylase in glycogen body tissue was assayed by measuring the release of phosphorus from glucose-1-phosphate during glycogen synthesis in the presence of glycogen body homogenate. The values for active phosphorylase in glycogen body tissue were very similar to values obtained for chick liver. If glycogen body homogenates were incubated 30 minutes at pH 7.9 in Tris buffer prior to assay, there was an almost complete disappearance of active phosphorylase. To assess the effect of glucagon on the amount of active phosphorylase, chicks were injected with 100 μg glucagon 20 minutes prior to removal of the glycogen bodies. Homogenates were prepared and assayed as before. Glucagon caused a 55% increase in blood sugar and a 22% decrease in active phosphorylase. (Supported by grant A-1266 from the U.S.P.H.S.)

71

RICHARD C. SNYDER, University of Washington. Bipedal locomotion. (25 min.)

Studies on locomotor adaptations of lizards reveal that bipedalism has been achieved with only slight modifications of appendicular morphology and mechanics. The major skeletal changes and muscular shifts that characterize birds and bipedal mammals do not exist. Bipedal lizards are characterized by decreased trunk length, long and heavy tails, narrow pelves, reduction of forelimb length and, usually, hindlimb elongation, proximal grouping of limb muscles and differences in relative development of muscle groups, particularly coxofemoral extensors, crural extensors and plantar flexors. The caudifemoralis muscles are unique in providing both power and speed in femoral retraction. Some lacertilian adaptations parallel those of cursorial mammals although the limb mechanics are quite different. Length of stride is a function of limb length, angle of limb swing, horizontal flexion of the vertebral column, rotation of the vertebral axis and the distance through which the acetabulum moves when the feet are off the ground. Bipedal and quadrupedal hindlimb movements are essentially similar, but stride length can be tripled in bipedal running while the rate increases only 10%. The tail acts as a counterpoise for head and trunk weight and as a lateral equilibrator.

Four gaits are utilized by lizards: the walk, running walk, trot and bipedal run, all symmetrical forms of locomotion. Analysis of locomotor cycles and structural adaptations of iguanids and agamids shows that mechanisms for bipedalism differ in species capable of comparable running efficiency. The iguanid pattern involves elongation of each hindlimb segment and extensive development of plantar flexors. Hindlimb increase in agamids, when present, occurs mainly in the pes and is associated with hypertrophy of the femoral retractors. These differences are reflected in the locomotor arcs of the appendicular segments.

The mammalian pelvis-limb orientation and loss of the heavy tail has increased the efficiency of limb movement, but greatly complicated the problem of balance in bipeds.

172

STEPHEN SUBTELNY and CAROLE BRADT, the Institute for Cancer Research, Philadelphia. Cytological observations on the early developmental stages of activated *Rana pipiens* eggs receiving a transplanted blastula nucleus. (15 min.)

Previous experiments indicate that a blastula nucleus introduced into an activated frog egg can unite with the female pronucleus prior to the first cleavage of the host egg (Subtelny and Bradt, '60).

Cytological evidence for this was obtained by fixing recipient eggs at 10- to 15-minute interva's beginning 30 minutes after activation and through the first cleavage period. Artificially inseminated eggs were fixed at comparable intervals of time and served as controls. Serial sections of 264 eggs were stained with Feulgen and fast green or Harris' haematoxylin. Cytological observations revealed that the series of events leading to syngamy between the transplanted blastula nucleus and female pronucleus is similar to that which occurs between the gametic nuclei in normal fertilization. During the initial phases of development, the female pronucleus can be identified by its relation to the animal pole and second polar body, the pigment trail formed by the descending pronucleus and by the weak Feuglen staining capacity of the latter. The blastula nucleus can be identified by its deeper location in the host egg, its association with a clear yolk free area and its ability to stain intensely with the Feulgen dye. The differential staining capacity also serves to distinguish the blastula nucleus when closely apposed to the female pronucleus up to the formation of the first amphiaster figure. In the experimental eggs, as in the control eggs, a single bipolar spindle is formed and the subsequent mitotic stages appear to be similar in both groups of eggs. (Supported by grant C-5743 to Stephen Subtelny and by grants C-5755CB and C-913-CIO to Thomas J. King from the U.S.P.H.S.)

120

ROY V. TALMAGE and REIKO YOSHIDA, Rice University. Influence of the parathyroids on frog bone. (25 min.)

Recent work with mammals has demonstrated the importance of parathyroid action in bone for the maintenance of plasma calcium levels. It has been postulated that serum calcium is maintained at normal levels by parathyroid action superimposed on a basic, primarily physico-chemical, equilibration level for calcium between bone and body fluids. Serum calcium homeostasis is maintained by continuous removal of calcium from bone as a result of the influence of parathyroid hormone on metabolic activity of bone cells. In this process, osteoclasts have been implicated because of their presence at most bone resorption sites and the fact that their numbers are increased in response to exogenous or endogenous parathyroid hormone. Recent work in our laboratory with *R. catesbiana* has enabled us to study parathyroid function in animals which can be maintained at temperatures sufficiently low to reduce cellular enzymatic activity to a minimum. Utilizing the technique of peritoneal lavage in bullfrogs, our studies indicate that parathyroid function in respect to bone is essentially the same in amphibians as in mammals. Parathyroidectomy reduced but did not abolish the ability of frog bone to continuously supply calcium to body fluids under the conditions of peritoneal lavage. Experimental conditions which altered endogenous parathyroid activity influenced markedly the numbers of osteoclasts which were found most frequently in bones such as the coracoid and sternum rather than in the long bones of the appendages. Peritoneal lavage of frogs maintained at 4°C indicated that some sort of basic physico-chemical process exists in the frog which permits the removal of calcium at this temperature in the absence of endogenous parathyroid stimulation or increased osteoclastic function.

220

KENNETH TAYLOR and HAROLD M. KAPLAN, Southern Illinois University. Histologic structure of turtle blood cells.

Numerous studies have been made on turtle blood, but morphologic descriptions of the cell types are confusing and contradictory. The blood cells of the adult red-eared turtle, *Pseudemys scripta elegans,* were examined in the light microscope. Cell, nucleus and granule diameters were measured on heparinized unstained cells. Total counts were made in isotonic saline solution. Smears were analyzed with Giemsa's, Wright's and Brilliant Vital Red stains. Seven distinct cell types appeared in the circulating blood, i.e., erythrocyte, lymphocyte, monocyte, basophil, eosinophil, heterophil (neutrophil) and thrombocyte. Contrary to some earlier opinions, no transitional cells between eosinophil and heterophil were found. Our results indicate that false conclusions have followed reliance upon a single stain. Immature forms were absent in the peripheral blood, indicating that blood cells have a long life span. Long viability is an asset in the hematopoietic depression during hibernation. A constancy found in contents, morphology and size implies that the blood cells are of a single, mature type. The constancy in size is useful to differentiate the cell types. There was considerable individual variability in the blood cell counts. Nembutalization produced no significant changes in cell count or size. Some data collected for *Chrysemys picta* revealed the presence of the same cell types, but the sizes were different.

221

EMMA D. TERRACINI and FRANK A. BROWN, JR., Northwestern University. Periodisms in mouse 'spontaneous' activity.

The 'spontaneous' activity in 6 male Swiss mice, 4 months old at the beginning of the experiment, was continuously monitored automatically from February 1 through July 31, 1959, and three of these until August 31, under constant temperature and illumination. From the pattern of hours of day that activity was above daily mean, it was clearly evident by inspection that, though these mice were closely associated in the same small enclosure, they displayed different periods of activity. Three mice exhibited cycles not different from 24 hours until July 31, (av. range 73%); then the single one of these continued showed about 24.90 hours. A fourth mouse retained for nearly 2 months a 24.0-hour cycle and then abruptly adopted and retained one of 24.25 hours. The fifth mouse had, steadily, a 24.30-hour period while the sixth mouse had one gradually increasing during its 6-month period from 24.18 to 24.50 hours. Randomizing the activity cycle of those three mice with sufficiently extended periods with overt cycles differing from 24.0 hours demonstrated these still to possess an underlying 24-hour component (av. range, 27%). Synchronizing to lunar-day hours four mice with overt 24.0-hour cycles, using simple multiples of 30 days, revealed these to possess a lunar-day fluctuation ($P<.001$), range, 15% (minimum, hour 3; maximum, hour 21). A significant ($P<.005$) monthly fluctuation present in the 6 a.m. activity was ascribable to periodic interference between solar and lunar day

cycles. These results suggest exogenous cycle-timing. (This research program is aided by contract 1228-03 with the O.N.R. and Grant RG-7405 from the N.I.H.)

91

ROBERT C. THOMMES and CONRAD E. FIRLING, De Paul University. Effects of glucagon administration on blood glucose levels of the chick embryo. (15 min.)

A comparative study of the abilities of the developing chick embryo to respond to and recover from a single administration of crystalline glucagon (Lilly) was conducted.

150 and 300 μg doses of glucagon were placed upon the chorio-allantois of 8-, 10-, 12-, 14- and 16-day embryos. Blood samples were drawn at half day intervals post administration until the time of recovery. Blood glucose levels were determined by the glucose oxidase method (Glucostat—Worthington Biochemicals).

The addition of glucagon on the C.A.M. causes a precipitous increase in blood glucose levels within the first half day after administration. The degree of hyperglycemia increases with the age of the embryo with the exception of the 12-day chick. Recovery is complete in all cases 1.0 to 1.5 days after administration.

The ability of 8-day chick embryos to recover from a glucagon-induced hyperglycemia in one day can be explained by the hypothesis that the embryonic chick pancreas produces and secretes insulin earlier than bioassay techniques have indicated.

The influence of glucagon upon liver and yolk sac membrane glycogen levels is currently being investigated. (Supported by research grant A-4527 from the U.S.P.H.S.)

154

WILLIAM THURMOND, California State Polytechnic College. A melanophore-stimulating substance in the hypothalamus of the tadpole and adult tree frog, *Hyla regilla*. (15 min.)

Evidence is presented which confirms the report that a melanophore-stimulating substance is produced by neural tissue of *Hyla regilla* (Thurmond, Anat. Rec. 137:398, 1960).

Infundibula from five previously hypophysectomized larvae were homoplastically transplanted into subcutaneous tissue of the same age albino tadpoles. Each graft caused melanin dispersion in surrounding host melanophores. Adjacent pigment cells showed maximum melanin dispersion whereas cells at a greater radius showed a gradation of this response to complete melanin aggregation a short distance from the implant. There was a slow continuous increase in the area of pigment response about each graft for 30-60 days at which time the host was fixed in preparation for sectioning and staining.

Eighty grafts from various parts of the brain of hypophysectomized adult *H. regilla* were similarly transplanted to 10 mm albino larvae. Tissue from the optic lobes, optic chiasma, paraphysis, floor of the medulla, and the diencephalon lateral to the preoptic nucleus did not evoke a pigment response in the melanophores of the host. Seventy-one grafts from the floor of the infundibulum and preoptic nucleus, however, caused melanin dispersion. The grafts from the posterior and mid-ventral infundibular areas evoked a continuous pigmentary response until fixed, whereas the grafts from the dorso-lateral, dorso-medial, and ventro-lateral parts of the infundibular floor and grafts from the preoptic nucleus evoked a pigment response for 36 hours or less.

222

J. W. TICER, W. S. TYLER, L. M. JULIAN and P. W. GREGORY, University of California, Davis. Influence of achondroplasia on the width and cell content of an epiphyseal line.

The influence of achondroplasia on the width and number of cells in each of the various zones of an epiphyseal line was investigated in a study of the distal metacarpal epiphyseal lines from 20 brachycephalic dwarf and 20 nonachondroplastic Hereford calves. The phenotype of the calves was determined by their general appearance, values of 3 metacarpal indexes (Am. J. Vet. Res., 22:693), and premature fusion of the spheno-occipital synchondrosis (Am. J. Anat., 100:269). The calves ranged in age from 1 to 169 days. The epiphyseal line of the metacarpal bone was selected for study as this bone has been shown to be most affected by the dwarfing process (Am. J. Anat., 101:447). Measurements were made and cells were counted in 10 columns of cells chosen at random across the epiphyseal line. The differences of the means were analyzed using Student's "t" test. No significant difference in the total width or in the total numbers of cells were observed. Differences significant at the 1% level were found in the zones of resting and proliferating cartilage. The zone of resting cartilage of the dwarf calves was narrower and had fewer cells. The reverse was observed in the zone of proliferation which was relatively wider and contained relatively more cells in the dwarfs. No significant differences were observed in the zone of maturing cartilage. (Supported in part by grants A-2626 and A-5321 from the U.S.P.H.S.)

223

CHARLES L. TURBYFILL, ROY P. PETERSON and A. L. SODERWALL, University of Oregon. Differential effects of filtered and non-filtered X-rays on the golden hamster.

In line with a study involving the effects of X-irradiation on aging and reproduction a series of various dosages of X-rays are being administered to young (4-6 months) adult male and female golden hamsters. Dosages range from 100 to 700r. Definite results are apparent at all dosage levels and range from modification of the reproductive performances as evidenced by reduced litter sizes, partial or complete blindness to depigmentation in the hair color.

With respect to the hair coat color, it was noted that in those animals which received filtered 500r and 700r a definite depigmentation developed becoming apparent by about one month after X-ray. In animals which received unfiltered X-ray the depigmentation appeared diffuse throughout the coat and was delayed, showing up in three months. If a 2-mm aluminum filter was used, cutting out the softer rays, the depigmentation assumed a definite pattern of bilateral symmetry appearing first as a single whitish patch above and between the eyes and progressing to areas including the shoulder and hip. After a period of six months the depigmentation becomes widely spread in filtered X-rayed animals resulting in a uniform

white coat. Those receiving unfiltered rays never attain the same degree of depigmentation. The condition of depigmentation is not accompanied with depilation. (Supported by A.E.C. contract AT (45-1)-1578.)

31

KENYON S. TWEEDELL, University of Notre Dame. Induced fluorescence of a frog renal adenocarcinoma grown in tissue culture. (15 min.)

Both renal adenocarcinoma and normal kidney were grown in tissue culture and fluorochromed with acridine orange or other vital fluorochromes. With subsequent ultraviolet irradiation, it was possible to differentiate normal and malignant cell components by their distinctive fluorescence. Likewise, cellular nucleoproteins could be identified on the basis of their fluorescence; RNA-protein fluoresces bright red and DNA-protein, yellow green. This specificity was verified by enzymatic digestion and specific histochemical dyes (Tweedell, '60).

Cultures were grown in optically ground depression slides using the Maximow double cover slip method combined with plastic discs. A modified growth medium (Duryee and Doherty, '54) consisted of horse serum, chick embryo extract, Amphibian Ringer, lactalbumin hydrolysate, antibiotics and Mycostatin. Parallel cultures were grown in light and dark at 26°C. Two procedures were used. Coverslips bearing tissue were removed from culture, washed in buffer, vitally dyed and studied in buffer mounts under U.V. Alternatively, tissues were grown with acridine orange in the culture and the fluorescing cells studied *in situ*. Cells multiplied and retained fluorescence over a two week period.

Cytoplasm of the normal cell fluoresced dark green while the nucleus and nucleolus appeared yellow-orange. Cytoplasm of the tumor cell fluoresced brilliant orange-red due to the abundant basophilia and occasional inclusion bodies were seen. The enlarged amphinucleoli exhibited a red fluorescent core of RNA-protein surrounded by a ring of yellow-green DNA-protein. The nucleus was often filled with a large red fluorescing inclusion body that presumably originated from the nucleolus. These bodies also pass into the cytoplasm. (Supported by grant from Allen County Cancer Society.)

42

V. L. van BREEMEN and J. HIRAOKA, The Mercy Institute for Biomedical Research, Denver. Ultrastructure of nerve and satellite cells of spinal ganglia of rats treated with malononitrile.

Electron microscopic studies were made of spinal ganglia of rats treated with malononitrile. Ultrastructural changes in nerve and satellite cell organelles at first observation seem subtle; they are nevertheless clear-cut at anesthetic dosages (6 to 8 mg/Kg body wt). In both cell types there is an increase in nuclear pore size. Membranes of the endoplasmic reticulum separate into small vesicular units (rather than being long plate-like structures), in effect greatly increasing their surface area. There is also an increase in the amount of dense material within the endoplasmic reticular vesicles. The Golgi complexes are enlarged and more vacuolated than normal, with some increase in the number of Golgi vesicles. The so-called "pigment granules" are increased in number in the cytoplasm of the nerve cell body from the treated animal. There is an increase in the complexity and extent of the agglomerate of very dense (lipid-like) bodies in the cytoplasm of the satellite cell.

Nerve cells of rats administered 0.3 mg (1.2 mg/Kg body wt)/rat/day for 8 days exhibit further cytoplasmic alterations. Clear space between Nissl bodies increases, containing primarily neurofilaments, which may be scanty in amount or more plentiful, being parallel in orientation in the open spaces. Furthermore a wide, clear "ectoplasmic" layer appears at the periphery of the cell body; this layer is almost devoid of structure, containing only very small short filaments (perhaps "protoneurofilaments"). Apparently the cytoplasm of both nerve cells and satellite cells is much more fluid in chronically treated animals than in normal animals. (Supported by grant NIH-B-2836 and the Multiple Sclerosis Society of Colorado.)

224

G. LAWRENCE VANKIN and H. CLARK DALTON, New York University. Embryonic grafting and drug experiments on melanophores involved in tail darkening of hypophysectomized urodele larvae.

In hypophysectomized urodele larvae tail melanophores (1) may remain stellate in response to stimulation from local tissues substituting for pituitary hormones or (2), unlike other melanophores, may not require extrinsic stimulation for pigment dispersal. Embryonic transplants in *Siredon mexicanum* and *Ambystoma maculatum* were made to decide between these possibilities. Grafts of stage 15 caudal medullary plate (region 3 and 4 of Niu, '54) to the dorsal trunk of crestectomized hypophysectomized hosts produced populations of stellate melanophores which spread as far as the ventral border of host myotomes. Similar grafts of posterior trunk and caudal neural fold produced populations of fully punctate melanophores, with a few stellate cells confined to the grafted fin. Tailbuds of stage 23 containing distal grafts of older anterior trunk neural crest (donor stage 29) differentiated melanophores earlier than any host region and showed almost no darkening after hypophysectomy of hosts, but were occupied instead by punctate melanophores probably contributed by the graft.

Since adrenalin lightens tails in hypophysectomized larvae, the possibility of cholinergic stimulation as a causal factor in tail darkening was tested by application of the anticholinergic drugs atropine, Banthine (Searle) and Pathilon (Lederle). None of these drugs affected tail darkening.

These experiments support the view expressed earlier (Vankin and Dalton, Anat. Rec. 138:386, 1960) that the melanophores involved in tail darkening are inherently independent of extrinsic stimuli for melanin granule dispersal, and that these melanophores originate largely from caudal medullary plate. (Supported by grant G-9875 from N.S.F.)

225

P. B. van WEEL and ERNEST T. TAKAFUJI, University of Hawaii. Effect of cations on the heart beat of *Achatina fulica* Bowdich.

In order to obtain a regular heart beat the excised heart should be ligated about the middle

of the atrium and at the ventriculo-aortic junction. It seems that the "top" half of the atrium has an inhibitory effect on the heart beat. 0.04 mol KCl/L causes a strong increase in amplitude, a definite increase in beat frequency, but at the same time a loss in tonus. 0.066 mol KCl/L slows down the frequency, eventually may cause a systolic arrest of the beat. The tonus level now appears to be markedly increased. Ringer's solution without KCl causes the arrest of the beat in diastole after a long time. NaCl follows the KCl pattern rather closely. 0.066 mol NaCl/L leads quickly to a *systolic* arrest at a markedly increased tonus level. In 0.05 mol $CaCl_2$/L the heart shows an increase in amplitude, but the frequency is not affected. In a few cases there occurs a complete separation of atrial and ventricular beats. Only the latter show the increase in amplitude. In 0.066 mol $CaCl_2$/L the beat frequency slows down markedly. Sometimes the heart ceases beating completely in diastole, but there is no change in tonus level. Ringer's solution without $CaCl_2$ causes systolic arrest of the beat, combined with a strong increase in tonus. Sometimes the arrest of the beat is not complete, but the tonus level is always high. 0.05 mol $MgCl_2$/L, like $CaCl_2$, leads to a strong increase in amplitude, but not in frequency. The tonus level becomes, however, markedly reduced. 0.066 mol $MgCl_2$/L causes a diastolic arrest of the beat, again combined with a loss of tonus.

123

CLAUDE VILLEE, Harvard Medical School. Mechanism of action of estrogens. (30 min.)

A theory regarding the mechanism by which estrogens may stimulate the growth of specific tissues has been elaborated based on studies of the properties of a specific estrogen-dependent pyridine nucleotide transhydrogenase found in endometrium, myometrium, placenta, mammary gland and pituitary. The enzyme is absent from other tissues examined—liver, kidney, heart, lung, and brain. The enzyme is distinct from the estradiol dehydrogenases, having been separated from them physically and showing a variety of distinctive properties. The transhydrogenase reaction cannot be mimicked by a combination of the DPN estradiol dehydrogenase and the TPN estradiol dehydrogenase. Histochemical evidence revealed that the DPN estradiol dehydrogenase is located in the decidua and trophoblast of the placenta whereas the TPN estradiol dehydrogenase is located in perivascular stroma (D. Kellogg and G. Glenner, Nature, 187:763, 1960).

The estrogen-dependent transhydrogenase is stimulated by estradiol, estrone, equilin, equilenin, diethylstilbestrol, and certain other estrogens. A comparison of steroid structure and function has emphasized the importance of an unesterified oxygen at carbon-17. The current method of enzyme preparation yields a 400-fold purification with a 20% yield. Kinetic studies of its properties suggest that both pyridine nucleotides are bound simultaneously to the enzyme and that hydrogen is transferred directly from one pyridine nucleotide to the other.

Studies with tissue slices or homogenates revealed that the stimulation of the system by estrogen leads to an increased production of ATP and an increased rate of synthesis of proteins, lipids, and nucleic acids, reactions which underlie growth. (Supported by research grant C-2400, U.S.P.H.S.)

116

CHARLES WALCOTT, Harvard University. The spider vibration receptor and the spider web. (15 min.)

A spider's vibration receptor is located in its legs. Thus the web is intimately related to the spider's vibration sensitivity. For this reason we have examined the role of the web in the spider's response to vibration.

The web of *Achaeranea tepidariorum* transmits frequencies between 100 and 20,000 c.p.s. with nearly uniform attenuation. Increasing the length of the web over which the vibrations were transmitted increased the attenuation only a few db. This implies that the attenuation of a spider web is low.

The area of the strands of an average web is about 2 cm^2. This suggests that the web should respond to air-borne sound. Attaching the tip of the spider leg to the web and recording the nerve impulses elicited by exposing this preparation to sound, shows that the web has greatly increased the sense organ's sensitivity. The changes in sensitivity to closely adjacent frequencies and the frequency discrimination of the receptors are present just as in the isolated spider leg.

A frequency analysis of the vibrations caused by insects ensnared in the web shows that the maximum energy occurs between 100 and 20,000 c.p.s. This is the range in which the spider's sense organ can discriminate frequencies. Although each kind of insect tested appeared to have a characteristic frequency pattern, we could detect no difference in the spider's treatment of the different insects. Thus, what use the spider makes of all the information provided by its vibration receptor is still unclear. (Supported by Quartermaster Corps, U. S. Army and Contract Nonr-3225(00), with the O.N.R.)

70

VLADIMIR WALTERS, University of California, Los Angeles. Hydrodynamic models for the evolution of body form in scombroid fishes. (10 min.)

Viewed from above the body outlines of scombroids resemble hydrofoil profiles. Bonito, tuna and swordfish swim 10 or more lengths/second; others probably do as well. Reynolds number (R) thus ranges from 1×10^6 (body length 0.5 meters) to 1.3×10^8 (body length 4 meters). In hydrodynamics the Joukovsky profile is usable when $R < 2 \times 10^6$; at higher values the laminar profile is more efficient; without flow control devices the upper limit for laminar profiles is 5×10^7. Scombrids are the smallest and least specialized scombroids; none exceeds 0.6 meters ($R < 3 \times 10^6$) and all have Joukovsky profiles. Some cybiids attain 2 meters (R to 3.3×10^7) and all have laminar profiles. Body shape in these families is correlated with body size; specialized flow control devices may be absent. Katsuwonids and thunnids span the range 0.6 to 4 meters ($R = 3 \times 10^6$ to 1.3×10^8) yet all have Joukovsky profiles; they should experience considerable drag unless they control turbulence. They are reported to have elevated body temperatures; the countercurrent arrangement of the vascular system indicates most heat is lost through the skin. The locations of the cutaneous vessels indicate heat exchange occurs behind the plane of maximal width. The cutaneous vascular system may function to thermally re-

duce water viscosity, thereby thinning the boundary layer and effecting drag reduction. Istiophorids and xiphiids range from 2 to 4 or 5 meters ($R=3.3 \times 10^7$ to 1.3×10^8 or more) but lack the cutaneous system. All have laminar profiles but even the smallest species operate near the upper limit for laminar profiles lacking flow control. The concave anterior body surface, posterior location of the gill openings, and integumentary pore-canal system may function in drag reduction.

226

ARTHUR C. WALTON, Knox College. The Amphibia as hosts of cestodes and acanthocephala.

The following records of the presence of cestodes and acanthocephalans as parasites of amphibians have been added to the Catalog of the Parasites of Amphibia since the listing in 1955. *CESTODA:*—BATRACHOSEPS ATTENUATUS (U.S.A.): The *Proteocephalus diana* of Helfer, 1948, has been transferred to the genus *Baerietta* by Douglas, 1958, and to the genus *Cylindrotaenia* by Lehmann, 1960; BUFO AMERICANUS (U.S.A.): *Distoichometra bufonis;* B. MAURITANICUS (Algeria): *Nematotaenia dispar algeriensis;* B. MAURITANICUS (Morocco): *Nematotaenia dispar chantalae;* DESMOGNATHUS F. FUSCUS (U.S.A.): *Baerietta desmognathi, Crepidobothrium amphiumae,* and *Cylindrotaenia americana;* ENSATINA ESCHOLTZII (U.S.A.): *Cylindrotaenia dianae;* EURYCEA B. BISLINEATA (U.S.A.): *Bothriocephalus rarus,* and Proteocephalid cysts of Fischthal, 1956; HYLA REGILLA (U.S.A.): *Distoichometra kozloffi;* PLETHODON VANDYKEI (U.S.A.): *Baerietta* sp? of Waitz, 1961; RANA CATESBIANA (U.S.A.): *Ophiotaenia gracilis;* R. ESCULENTA RIDIBUNDA (Europe): *Tetrathyridium mesoestoidini;* R. sp? of Flores-Barroeta, 1955 (Guatemala): *Proteocephalus hernandezi;* and TARICHA TOROSA (U.S.A.): *Bothriocephalus rarus. ACANTHOCEPHALA:* — BOMBINATOR IGNEUS (Poland): *Acanthocephalus ranae;* BUFO BUFO *(= vulgaris)* (Poland): *Acanthocephalus ranae;* RANA CLAMITANS (U.S.A.): larval Acanthocephalans of Odlaug, 1954; R. ESCULENTA RIDIBUDNA (Europe): *Acanthocephalus ranae;* R. SYLVATICA (U.S.A.): larval Acanthocephalans of Odlaug, 1954; and R. sp? of Datta & Soota, 1954-56 (Afghanistan): *Acanthocephalus kabulensis.*

227

ALLYN J. WATERMAN, Williams College. Thyroid gland of the young alligator, *A. mississippiensis.*

Young alligators one year old or less, weighing 48-147 gm and measuring 9.8-16 cm in length from snout to middle of vent, were analyzed for thyroid activity by intraperitoneal injections of 4-8 microcuries of I-131 following treatment with drugs (scintillation counting). Thyroids weighed 8-36 mg. Water was available at all times, but not food. Uptake values for controls averaged 1.7% of injected dose after 3 hours (mean of 6 animals); 5%, 6 hours after injection; 5.7%, 18 hours; 8.3%, 24 hours; 8.8%, 48 hours; 9.7%, 72 hours; 17%, 96 hours; 19.6% (peak) or 0.8%/mg of thyroid, 120 hours; 14.2%, 144 hours; 7.8%, 168 hours. Turnover of I-131 by alligator thyroid at this age is slow and it remains available for some time. Ratio of blood-per cent X body weight / 10 decreased steadily from a value of 10 at 3 hours to 2 at 120 hours. Protein-bound radioactivity of serum (ice-cold TCA precipitation) ranged from 5% at 3 hours to 28% at 18 hours to 9% at 144 hours. Thyroid stimulating hormone (0.1-1.0 USP unit/day for several days) provoked only slightly decreased radioactivity up to 96 hours after injection of I-131. Propylthiouracil reduced radioactivity to 1% at 24 hours. Repeated KI injections (1 mg) reduced thyroid radioactivity to around 4 times background count at 3-24 hours. Trauma (removal of ends of tails) reduced radioactivity to 3.3-3.5% at 24-48 hours. Thyroxin, 0.01-0.25 mg, decreased radioactivity to less than 1% between 3 and 24 hours. (N.S.F.-G7473; Waubun Laboratory, Carolina Biological Supply Company.)

228

ALLYN J. WATERMAN, Williams College. Thyroid gland of the young "slider" turtle, *Pseudemys scripta.*

Thyroids of late embryos 59-62 days, weight 2.5-3.7 gm, contained 8.8% of 5-7 microcuries I-131 at 5 days after injection (39 embryos; range 4.5-17.6%). Embryos were light in color, reacted vigorously and made strong swimming movements in water, and eyelids were open. Injection was made through the under side of the shell when the egg was held with the chalky-white area uppermost. This minimized loss of contents which generally occurs when injection is made through the white area, which in turn marks the location of the embryo and must always be kept uppermost. An airspace is lacking, and eggs cannot be rotated. The injection opening may be sealed. Egg laying commences around April 15th in Louisiana; eggs are collected daily by commercial breeders from the borders of turtle ponds and stored in artificial nests at room temperature for incubation. Thus dated eggs are available. Single doses of thyroid-stimulating hormone (0.2, 0.5 IU) failed to increase I-131 uptake at 5 days, propylthiouracil (0.5 mg) decreased uptake (0.27% of dose), Dl-thyroxine was toxic (0.1 mg).

In contrast, the posthatching thyroid averaged 18.3% in May (10 animals), 6.6% in August and 2.1% in October on the fifth day; peak uptake at 96, 72 and 96 hours (24.6, 23.3, 2.7%), respectively; body weight 6.8-10.3 gm. Internal yolk is present for weeks after hatching. Potassium iodide, thyroxine and propylthiouracil reduced 24-hour I-131 uptake to less than 0.5% of dose in May. (N.S.F.-G7473; Waubun Laboratory, Carolina Biological Supply Company.)

229

CHARLES G. WILBER, Department of Biological Sciences, Kent State University. Some time relations of the electrocardiogram in reptiles.

In various experiments on reptiles control electrocardiograms were taken on a variety of species at different temperatures. Species of snakes, turtles, lizards, and the American alligator were observed. Time relationships were calculated from the basic results. The following equation, $Q\text{-}T = K\sqrt{RR}$, was used to calculate K for all reptiles studied. Mean value of K was found to be 0.78

± 0.19 at a mean heart rate of 43 ± 16 beats per minute. If the values for K are plotted against the respective values for heart rate a straight line is obtained which can be expressed as, $y=1.18-0.0091x$, where y is K in arbitrary units and x is heart rate in beats per minute. The P-R interval varies fairly regularly with heart rate, $y=0.68-0.0072x$; $r=0.89$; where y is P-R and x is heart rate. In other words, rate of transmission of impulse from pacemaker to ventricle in the reptilian heart increases linearly with heart rate: $y=0.08x-0.57$, where x is the heart rate and y is the relative rate of transmission of impulse. A series of experiments on intact *Pseudemys* sp. indicated that heart rate varies with body temperature, between 20°C and 35°C, linearly, $y=3.57x-56$ $(r=0.98)$, where y is heart rate in beats per minute and x is body temperature in degrees C.

Q10 value for the heart in intact *Pseudemys* decreases with elevated temperature. (Supported in part by U.S.P.H.S. Grant MY-3235.)

130

PAUL W. WINSTON and V. E. NELSON, University of Colorado. The uptake of atmospheric water by larvae of *Tribolium confusum.* (15 min.)

It has been an hypothesis in this laboratory for a considerable period that it would be a distinct adaptive advantage for small terrestrial arthropods to be able to actively remove atmospheric water from the air during periods of relatively high humidities. This applies especially to those which are able to live most of the time under dry conditions and to quiescent stages which cannot replenish lost water. The weighing of very small forms under controlled conditions has not been feasible, but the development of the Cahn electronic balance which is in use in our laboratory, allows the measurement of changes of the order of a few micrograms. Larvae of *Tribolium confusum* were weighed during periods of desiccation and subsequent exposure to various higher humidities at 25°C. From saturation to 80% R.H. there was no further weight change in 40 hours, but at lower humidities there was progressively greater loss which reached 5.5×10^{-6} grams/hour in large larvae. This seemed to indicate that no active uptake was occurring as has been inferred in many studies. However, when the loss of weight due to metabolic activities was taken into account, it could be seen that there was some uptake at the higher humidities. Oxygen consumption in starved larvae was measured at different humidities, and calculations were made of probable weight loss based on the O_2 utilized in the oxidation of fats. As the larvae did not gain weight above 80% R. H., then there must be either a mechanism for uptake which cannot replace lost water or a regulatory one which functions to maintain the status quo.

39

THEODORE R. F. WRIGHT, Johns Hopkins University. The genetic control of an esterase in *Drosophila melanogaster.* (15 min.)

The starch gel electrophoretic patterns of esterases of two strains of *Drosophila melanogaster* were found to be strikingly different. A genetic analysis has shown that this difference is controlled by a single locus on the third chromosome. To date only two alleles have been found. Individuals homozygous for one of the alleles, Est 6^F, have a strong single band which migrates faster than a similar strong single band found in individuals homozygous for the other allele, Est 6^S. The heterozygote, Est 6^F/Est 6^S, exhibits both the electrophoretic fast esterase as well as the slow esterase. The heterozygote does not contain a hybrid esterase with an electrophoretic mobility intermediate between the fast and the slow esterases. It appears that in the heterozygote the two alleles show no dominance, i.e. are codominant, each allele controlling the production of a similar, but not identical, protein. Quantitative data concerning the relative activities of fast and slow esterases in their respective homozygotes, Est 6^F/Est 6^F and Est 6^S/Est 6^S, and in the heterozygote, Est 6^F/Est 6^S, will be presented. All of the above genetic and quantitative work has been done with the use of the non-specific substrate for esterases, alpha naphthyl acetate. So far both the Est 6^F and the Est 6^S esterases are not distinguishable on the basis of their substrate specificities nor in their sensitivity to various inhibitors and activators. Neither of these esterases are cholinesterases for they are not inhibited by 10^{-4}M eserine sulfate. The possibility that they are lipases, chymotrypsins, or one of the three catagories of non-specific esterases will be discussed. (Supported by grant G-11328 from the N.S.F.)

40

CHAI HYUN YOON, Boston College. Serum cholinesterase activities of neurological mutants in mice. (Introduced by W. D. Sullivan) (15 min.)

Three neurological mutants named tremulous, waddler and quivering were studied for their serum cholinesterase activities. The enzymic levels were lower in both male and female tremulous mice compared to their normal sibs. This was also true with quivering females, but no difference was found between quivering males and their normal brothers. On the other hand, waddler males showed a higher enzymic level compared to their normal brothers, but no difference was found between waddler females and their normal sisters. In addition to the now well established sex differences, some significant strain differences were observed. From the above results it was concluded that the serum cholinesterase levels are altered in the three neurological mutations investigated but that the final expression of these alterations in enzymic levels is dependent upon the interaction of the original enzymic level changes and the genetic constitution of the mice in which these changes occur. Various tests showed that the serum cholinesterase in mice is predominantly pseudocholinesterase and true cholinesterase activity is negligible if present at all. (Supported by grant B-2267 from the U.S.P.H.S.)

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Am. Zoologist, 1:481-487 (1961).

THE CHALLENGE AND RESPONSIBILITY OF ZOOLOGY

Presidential Address of August 30, 1961

C. Ladd Prosser
University of Illinois

A presidential address is a final act, the swansong of a faithful society member before he is put on the shelf as an elder statesman. It is an opportunity that comes once in a lifetime to unload to a captive audience some of the problems that have been troubling the president, but for which he has no answers. I am not going to discuss my own research interests, except in passing; what I have to say might, if it were not for political overtones, be best called "The state of zoology in 1961." It is well for us to pause occasionally and take stock of our science in its broader aspects. At our national meetings and in our teaching we become so engrossed with technical minutiae that we neglect the vistas and generalizations and forget the impact of zoology on other sciences and on the public at large. In no phase of human endeavor is change so evident as in science, and science has been called "the dominant culture pattern of the 20th century" by Marston Bates. I wish to speculate briefly about vistas in zoology and then to ask how zoology is faring in relation to other sciences and how we are discharging our responsibilities to the public.

Science grows in a saltatory fashion. Someone invents a new technique or opens a field by a new hypothesis, then many others follow, consolidate the advances, hold the ground until a new break-through, a new "fad", appears. Progress is not always direct, it may be in circles or spirals. The history of zoology is replete with examples of sudden shifts of emphasis. I am relatively young, as society presidents go, but in my thirty-five years as a professional zoologist I have seen numerous break-throughs and I shall cite a few examples which seem to me to be outstanding. To a large extent these are reflected in the topics of Nobel prize awards.

When I was an undergraduate the recognition of the chromosomal basis of Mendelian genetics was relatively new. Morgan and his associates at Columbia published the *Mechanism of Medelian Heredity* in 1915 and the *Physical Basis of Heredity* in 1919. The extension of Morgan's type of analysis to organisms other than *Drosophila* kept many zoologists busy for a generation. Shortly after World War I and culminating in his Royal Society lecture of 1927, Hans Spemann achieved a major break-through with his organizer or induction principle in embryology. The elusive organizers still beckon experimental embryologists. In animal physiology an important break-through of the twenties came from Gasser and Erlanger in America, and Adrian and Matthews in England in the application of electronic amplifiers to establish the pulse nature of nerve impluses and the different properties of various fiber types. A little later Otto Loewi's discovery of acetylcholine as a synaptic transmitter opened a new vista for neurophysiology. The next major achievement in this field came in 1950 with the discovery by Hodgkin and Huxley of the ionic basis of nerve conduction. In evolutionary theory there were no major advances during the early part of this century until the recognition in the thirties and forties almost simultaneously by a number of evolutionists—Wright, Dobzhansky, Mayr, Simpson, Fisher and Ford—of the principles of population genetics. This has led to an explosion of publications on the processes of speciation.

One of the most notable achievements of modern biology has been the elucidation of how energy is made available for the activities of living organisms. Some of the enzymes of cellular oxidation had been examined in the early twenties by Warburg and Wieland, but it was not until the rec-

ognition by Lundsgaardh, Lipman and others in the late thirties of the importance of high-energy phosphate bonds that intermediate metabolism blossomed into a major branch of animal biology. Protein specificity as the basis of distinction between species and even between individuals led to two Nobel prize awards—Landsteiner's in 1930, and Medawar's in 1960.

Two recent break-throughs have come more from microbial than from animal biology. One of these was the identification of the genetic material as deoxyribose nucleic acid and the fitting of the genetic code to the Watson-Crick model of a DNA chain. A second was the identification by Beadle and Tatum of specific genes with the synthesis of individual enzymic proteins. At about the same time enzyme induction was discovered; now more biologists seem to be working on the role of nucleic acids in protein synthesis than in any other field, and the implications extend from genetics and development to physiology and evolution.

So much for the past, what predictions can we make for the future of animal biology? The list which follows is my own, each of you might speculate differently. It seems to me that a major problem facing us today is that of extrapolation. On one extreme we have molecular biologists who imply that the behavior of a purified protein in the test tube is the same as that in an intact cell and at the other extreme are certain ethologists and clinicians who think that to tamper with an animal is to preclude meaningful observations. Serious mistakes are being made in unjustified extrapolation from one level of organization to another. For example, the properties of hemoglobin are different inside or outside a red blood cell, an actomyosin thread is a very limited model of an intact muscle fiber, the assignment of descriptive names to the social interactions of animals provides false security as to the bases for their behavior. A living cell is more than a bag of enzymes. We need to study life at all levels but real wisdom is needed in extrapolation from one level to another.

A second area for the future is less controversial—the coding of genetic information and the expression of this information in biosynthesis. There is more to genetics than DNA, but it is a safe prediction that the secrets of replication of nucleic acids will soon open a new field of biology. Closely related is the more difficult question of how genes control differentiation and development; the organizer principle is giving way to more specific molecular models. Here we are reaching the ultimate parameters of the origin and nature of life.

One of the most far-reaching of predictable break-throughs is biological control. This has two aspects—internal and external. We have known of homeostasis since before Claude Bernard, but we know virtually nothing of how enzyme levels are regulated, or what determines the amount of energy released for a given function; we do not understand the intimate action of any hormone in any animal. Some animals maintain internal constancy by elaborate feedbacks, others tolerate an extreme range of internal chemical and physical variation. The subleties of these regulations are challenging at each level of organization. By external control I mean the regulation of organisms by the environment. Natural selection operates on *capacity* for adaptive variation and the genotype sets the limits within which individual animals can vary. We avoid implications of what we call Lamarckism, yet we know little of how environmental stresses filter out the changes on which natural selection acts. Part of this filter may lie in the control of enzyme synthesis, part in nervous lability. There may well be unsuspected cytoplasmic-nuclear interactions. Also it is probable that there are unsuspected environmental influences on living organisms, for example magnetic and electrostatic effects. The ecology and systematics of the future must take account of the intimate mechanisms of en-

vironment-organismic interactions; the molecular basis of natural selection.

Another area where break-through seems imminent is animal movement. The speeds of animal movement cover a 10,000-fold range. Contractile proteins seem to be similar in ameboid cells, sperm and muscle, but the subtle basis for their activation and the configurational changes which make animals so different from plants still elude us.

A most challenging area of zoology and one where there are too few leads at present is central nervous integration, the nature of the mind. Ethology, the study of behavior, has made great strides in the past few years, but it is reaching the limits of its descriptive phase. Neurophysiologists have learned much from giant fiber systems of invertebrates, but these are scarcely even models for what goes on in the small-fiber aggregates of the neuropile. Chemical control of behavior has now progressed beyond the science fiction stage; yet we have virtually no clues to guide in studying the bases for learning, memory, inherited engrams and the like.

Finally, I mention what might be called the biology of the individual. We have relied in much of zoology on statistical averages, on probabilities and in our evolutionary theory on population genetics. We tend to minimize individual variation. Every anatomist is aware of the high percentage of so-called anomalies for nearly every character. Immunologists have recently emphasized the incompatibility of tissue proteins, not only between species but also between individuals after a certain stage of development. Roger Williams has called attention to the wide variability in physiological, psychological and biochemical characters of "normal" humans. Natural selection acts on populations, particularly those at the limits of a range, but these populations are composed of individuals which differ by small degrees. If there were no individual variation there could be no evolution. There is need for a new theoretical biology of the individual.

I have enumerated some of the challenging areas of generalization of the immediate past and the probable future. The microbiologists and biochemists seem to be moving faster toward biological generalization than are the zoologists. Perhaps a more frequent look at broad goals will help us decide how much it is worthwhile to repeat on different animals what has been done before and whether our anlaysis of minutiae is leading to general principles. Certainly the challenges of zoology are tremendous.

I now turn to a different kind of self-evaluation,—our success in creating a favorable public image of zoology. How are we facing the social responsibilities of our profession? I believe that the average thoughtful citizen considers animal biology only in terms of medical practice, display museums, and the advances of animal husbandry; he is unaware of the social and philosophical implications of biology. He fails to realize that the prolongation of life in recent years has come not only from medical practice, but from basic biology—nutrition, biochemistry, and related fields. It has been said with some truth that in science the most spectacular progress during the generation between World War I and 1945 was in chemistry, particularly with the development of synthetic organic chemistry; that since World War II physics with the unleashing of atomic power and the direct exploration of outer space has had increasing social and economic importance, but that with the solution of such biological problems as I have listed above, particularly elucidation of the nature of life and of mind, biology will become far more powerful in determining the future of mankind. Indeed many of the political and social problems of our world today have a biological basis which our political leaders ignore. A few examples of the public attitude are enough to show how we are failing to create a favorable image.

As zoologists, we consider that evolution is the one principle which integrates our entire science. Yet most non-biologists either disbelieve in evolution or fail to accept its implications for man. Of the ten current general biology textbooks for public schools, eight, including the most widely used one, do not list the word evolution in the index*. Publishers of high school texts in biology have repeatedly warned authors to avoid a proper treatment of evolution. The adverse coverage given in the public press to some of the Darwin centennial celebrations, particularly when human evolution was mentioned, indicates the lack of acceptance of this cornerstone of zoological theory.

In advocating conservation of natural resources the zoologist continues to meet public apathy or even opposition. When preservation of a unique habitat for wildlife conflicts with interests of industry, forestry, or marginal agriculture, or, as in Africa with unstable politics, often the conservationist loses. We now face such issues for the Indiana Dunes and for some of the National Park areas of southern Utah.

Further evidence that we are failing comes from the state laws that prohibit animal experimentation in biology courses in public school. An Oklahoma law states that "No experiments on any living creature shall be permitted in any public school." Six states have similar laws and the antivivisectionists are pushing hard elsewhere. Two bills are now before the Congress which would virtually stop our whole zoological science. The Griffiths bill (HR 1937) would regulate use of all vertebrates while the Moulder bill (HR 3556) would regulate "any species capable of developing a conditioned response." Experiments on either warm-blooded or cold-blooded vertebrates, on invertebrates and even paramecia would be permitted only if plans are approved by the commission, numbers of animals specified far in advance, and anesthesia administered by qualified anesthetists. Thus zoologists in agricultural, fisheries and marine stations as well as in university, governmental and industrial laboratories would be greatly hampered in freedom of research. These bills are far more hampering than the British antivivisection laws. Many of our non-biological academic colleagues favor such legislation. It is evident that our profession is seriously threatened, that animal biologists among all scientists are suspect as cruel and inhumane, that we are not to be trusted as to motives or practice. That such legislation exists and is proposed, that leading newspapers carry advertisements stating "Our goal is to stop all vivisection," is evidence enough of our failure to create a favorable image of zoology.

Even more serious is evidence that the brightest youths in our country are avoiding biology as a career. Numerous surveys of the past two decades have indicated a gradual decline in the attraction of biology in terms of general intelligence of those entering it professionally. The most recent, is the analysis by Harmon of the Ph.D.'s of 1958 (Harmon, L. R. Science *133:* 679-688, 1961). By all criteria—general intelligence scores, rank in high school class, grade point averages and others—mathematics and physics attracted the best students, followed in order by chemistry, geology, and engineering, social sciences and arts and humanities while biology was second from the bottom with education attracting the least able students. Unfortunately medical students were not included in this analysis and many biologically oriented youths choose medicine. However, the number of Ph.D.'s was large and the results of this survey agree with earlier ones that biology is not attracting the best students. To quote, "It is apparent that the fields of biology and education have not been able to attract their proportionate share of individuals of highest intelligence, as intelligence is judged from high school intelligence test scores. As the problems in these fields are certainly as challenging as those

*Data from Biol. Sci. Cur. St.

in the physical sciences or social sciences, it might be inferred that there is a failure somewhere, probably at the high school level or even earlier, to present these challenges adequately to the bright young people who eventually attain doctoral degrees." Perhaps it is a sign of age, but I fail to find among our present generation such dedicated intelligence as I observed in Morgan, Jennings, Conklin, Parker, Lillie, Mast, and Harvey. Somehow we are failing to present the challenge of zoology to the youth of America.

The most serious biological problem in the world today is the growth of the human population. We have failed completely to impart to governmental leaders and to the public at large the meaning of a growth curve and its application to man. Part of the reason for the present growth lies with biologists, who have provided the basic knowledge which made possible the prolongation of life expectancy. The present rate of increase of the world population is 45 million or 1.6 per cent per year. Von Foerster *et al.* (Science *132:* 1291-1295, 1960) have presented an equation which describes with remarkable accuracy the human population over the historical period and they predict that at the present cumulative rate the human population will approach infinity in the year 2026 A. D. They prophetically refer to this date as Doomsday. It has been argued that technological advances have consistently kept up with the growth of human populations, that with the probability of use of synthetic food and of converting sea-water to fresh and the availability of nuclear power, Malthusian principles do not apply, that animal populations are self-limiting when the "carrying power" of the environment is reached. There is good evidence, (Stamp, L. D. Nature *188:* 9-11, 1960) however, that present technological advance, particularly in nutrition, is slower than the present population increase, that the present population of 2.9 billion persons requires 1.2 acres in cultivation per person, that despite this at present 60 per cent of the world's population has less than 2200 calories per day, that by the year 2000 for each of the expected 6 billion persons there cannot possibly be more than a few tenths of an acre in cultivation, and that the mean density will be some 200 persons per square mile over the entire surface of the earth. Psychological effects of crowding are as bad as nutritional effects. As Von Foerster puts it, even with synthetic food the real problem will be to keep from being squeezed to death. The frightening fact is that the year 2000 is less than forty years away. Some people even anticipate an atomic war as a leveler of population, a grim solution indeed.

Of course, at present the increasing population is good for business. Sex provides the main pleasure remaining for crowded starving people in nations where there is no hope for the individual. It is in such countries that communism is finding fertile ground for infiltration. Yet our public, our political leaders, our newspapers seem to think that by closing their eyes to the population explosion they can make it disappear. As the zoologist, Oscar Riddle, has quoted, "it is as if they (the political leaders) had been acting on the premise that the Communist threat would go away if it were made unmentionable." We grant billions in foreign aid in such a way that the social problems may even become intensified. We, the people of the world, are acting as if we had no responsibility for our children and their children.

The population pressure is not a matter of politics or morals, but of objective biology. Zoological and demographic scientists must be supported in research on control of birth rate. The *application* of such research is not our province and it may take many forms according to social, religious and political situations—taxation in proportion to the number of children, licensing couples to have children, providing free birth-control aids in overpopulated areas and other means. However, our responsibility as zoologists is to emphasize

in no uncertain terms to non-biologists, especially to governmental leaders, the reality and seriousness of the biological problem.

Another important application of biology which has been emphasized in the press but which seems not appreciated by the public is the potential effects of the weapons of atomic warfare. The threat of genetic and carcinogenic effects of radiation, the mass destruction of populations may be a mild but only temporary deterrent to war. The suggestion by Tracy Sonneborn and others that we should gather plants and animals and men in some least vulnerable spot on earth—a modern Noah's ark—is not to be taken lightly.

In addition to these social applications of zoology, we seem to have failed in presenting the positive features of our science, of which we can here list only a few. Our textbooks fail to mention the beauty of nature even at the molecular level, the esthetic satisfaction sensed by classical naturalists in their observation of birds or insects and equally by experimentalists in observing the integration of cellular function and the sensitive feedback processes of homeostasis in all organisms. The versatility and symmetry of a hemoglobin molecule is as much a thing of beauty as the flight of a gull or tern. The thrill of discovery is equalled only by the esthetics of harmony in nature.

Then there is the rich biological heritage of man, the sense of belonging to a noble evolutionary line, the sharing of common properties with all living things. As a corollary, new properties emerge at each level of increased biological complexity, properties which could not be predicted from analysis of a lower level of organization. In man, with his complex neuro-endocrine organization, qualities of abstraction, speech and memory appear which provide the basis for cultural evolution. This biological perspective gives meaning to the nature of man that forms the basis for a reasonable philosophy and ethics.

Certainly zoological science has much that is positive to contribute to society besides technical facts concerning animals.

Finally, despite increasing scientific reporting in the press, the public seems ignorant of the real meaning of the approach used by scientists. There is genuine fear of science, fear strengthened by development of atomic warfare, of thought control. We are asked to supply final answers when the essence of science is the tentativeness of its conclusions. It has been said that literature is truer than science because in science one always must have the latest edition. We are questioned about problems which go far beyond the limits of available techniques. Opinion is accepted in lieu of controlled observation. It has rightly been stated that science differs from democracy in that scientific truth is not attained by a vote. The public evaluates research mainly in terms of direct application and applied research is better supported than the search for basic knowledge. The distinction between applied and basic research is not always sharp, but one definition I like is that in an applied problem the answer is final whereas in a fundamental problem the answer is another question. It seems unfortunate that much of the support of science in America is under the guise of military defense.

The preceding examples could be amplified many times. It is evident that the challenge of zoology is great and that its future will expose far-reaching problems. It is also evident that in the public image, zoologists are inferior to other scientists. It is also apparent that zoology touches on many sensitive areas which require courage for presentation.

The causes for the apparent low respect toward zoologists are not clear. In part, they rest with our elementary courses which are packed with detailed information and in which examinations stress memorization of facts rather than comprehension of principles. Even graduate students complain that they miss the wood for the trees in their courses. In research, we are so en-

grossed with minutiae that we neglect general laws. It is relatively recent that our own professional society has admitted that social and political applications of zoology are worthy of discussion at our business meetings. Popular writers emphasize sensational and unique bits of natural history; animal experimentation is considered for its medical application and not as a way to learn the secrets of life. Many press releases distort scientific truth and approach falsification. Serious social and philosophical applications of biology are mainly confined to books which have small circulation. Antivivisectionists command considerable political influence. The salary scale for physical scientists is about 20 per cent higher than for biologists at equivalent ranks, largely because of greater industrial demand. Our national expenditures for space engineering are far greater than for the study of life processes; this results in part from congressional fear of Russian domination.

I conclude that the state of zoology in 1961 is not good but that our science has great potentialities. What can be done to improve our status? I have no certain answer, but the first requirement is that we recognize the problems and avoid a sense of complacency. Education at all levels must be scrutinized. The high school courses being developed by B. S. C. S. are a move in the right direction and, despite disagreement over details, these courses deserve our whole-hearted support. It is difficult to discard old details as a subject grows, hence the tendency is to overwhelm students with masses of facts. We must be more selective in our illustrations of general principles. We need to establish better contacts with publishers and the press. We must make the truths of our science known in legislative halls; it is useful to invite legislators to visit our departmental laboratories. Somehow we must transmit to the public the generalizations and human implications of zoology and we must impart to the best students in our high schools and colleges the feeling that zoology presents challenges for exploration that are even more exciting than those of physics and mathematics, that to understand the nature of life is as rewarding as to become an astronaut. Individually, we must take time to talk with students in high schools and colleges. Certainly we are in as strong a position to justify monetary rewards as are microbiologists and biochemists. We shall not improve the public image of zoology by merely extending some of the principles of microbial biology to animals but we must, in addition, exploit those unknowns peculiar to animal biology.

Zoology has a rich heritage and a challenging future. I hope that the American Society of Zoologists may help us collectively and as individual animal biologists to discharge our responsibilities to our science and to society more effectively.

PROCEEDINGS OF THE INTERIM BUSINESS MEETING OF THE AMERICAN SOCIETY OF ZOOLOGISTS

AUGUST 29, 1961, PURDUE UNIVERSITY

The meeting was called to order by President Prosser at 5:25 p.m. Approximately sixty-five members were present. Dr. Metz, the Secretary, presented a report on the status of the membership as follows. Two new classes of membership were created in the new Constitution approved by the Society at its December, 1960 meetings. These are: Corresponding, which is really an honorary foreign membership, and Student. At the December Executive Committee Meeting, ten Corresponding Members were elected to the Society; all of these have accepted their elections. Up to August, 1961, a total of 147 qualified Student Members have been nominated and enrolled in the Society, Emeritus Members include 96, and the total Regular Members, including six elected at the Executive Committee Meeting on August 26th, number 2,143 for a grand total membership of 2,396 members. Since August 1, 44 nominations for Regular Membership and 52 for Student Membership have been received; those meeting the requirements will be enrolled as of January 1, 1962. Nomination forms, one student and one regular, are sent out with each of the two annual mailings of call for papers; however, individuals who wish more nomination forms may obtain these by writing to the Secretary.

Dr. Metz next called for suggestions with regard to the newsletter and the brochure. Dr. Saunders requested that copies of the brochure and nomination forms be made available at regional meetings, refresher courses, and training program sessions so that the participants in these may obtain information concerning the Society and have an opportunity to fill out nomination forms. Dr. Prosser emphasized the need of the Divisions to contribute information concerning their activities for the newsletter. Suggestion from the floor was made that news material be published in the *American Zoologist*; however, it was pointed out that the *American Zoologist* has a wider circulation than the members of the Society and is in the nature of a permanent journal rather than a newsletter.

Dr. Kollros, the treasurer, reviewed the finances of the Society. He pointed out that the large amount of grant money handled by the Society now, although it makes a large treasury figure, is largely committed before it is received. However, overhead funds do become available for general Society use. Dr. Kollros predicted an $8,000 uncommitted balance as of January 1, 1962. He pointed out the desire of husband and wife pairs to receive only one copy of the *American Zoologist* and have a reduction in the dual dues. He informed the membership that the Executive Committee had approved this action with a $3.00 reduction in the dual dues.

Dr. Crowell, Editor of the *American Zoologist*, reported on the status of the journal. He reviewed the history of the three issues that had appeared so far and explained the financial status of the journal. It appears that the journal will go into the red this year, the deficit to be made up out of the general Society funds. In replies to questions, Dr. Crowell indicated that separate copies of particular issues could be purchased for three dollars a copy. Likewise, for bulk purchases of a single issue a ten per cent reduction might be anticipated.

Dr. Prosser next called upon Dr. Waterman, Chairman of the Education Committee, to report on the activities of his group. Dr. Waterman first reported on the Summer Institutes including the Comparative Anatomy Institute to be held at Harvard in the Summer, 1962, an Animal Behavior Insti-

tute to be held in the Summer of 1963 at Penn State under the leadership of Dr. Schein, and a Comparative Physiology Institute to be held at Carleton College in the Summer of 1964. Subsequent Summer Institutes under consideration are a Protozoology Institute and possibly a Parasitology Institute, although the Society of Parasitologists is contemplating organizing an institute which would make it unnecessary for the Zoologists to organize such a meeting. Dr. Waterman reported that unforeseen difficulties developing at a late date had made it impossible to hold a Summer Institute in 1961. He further indicated that conference programs, sponsored by the ASZ, were under investigation. It appears that the difference between a conference and an institute is that the conference lasts less than four weeks whereas an institute lasts longer.

The "Careers in Zoology" brochures were next discussed. The supply of the present brochures is exhausted and a new printing of a limited number is to be made as soon as possible and, subsequently, a rewrite of the present brochure with an updating of information will be made.

Dr. Prosser next discussed future meetings. The Christmas meeting will be in Denver in 1961, the Society will meet with AIBS at Corvallis, Oregon, in August, 1962. Dr. Bishop, the ASZ representative to the AAAS, reported on plans for the meeting with AAAS at Denver in December of 1961. A long program including a number of symposia, among them one on physiological and biochemical aspects of human genetics will be held. Dr. Watterson reported that the symposium on Arachnid behavior, planned for the Denver meetings, had been cancelled. He had available copies of the tentative program for the Denver meetings.

Dr. Prosser next reported on intersociety relations. He outlined the problems of handling the housekeeping activities, or business activities, of the Society and noted that these problems were also shared with other animal biology societies. The second problem was that of Washington representation, a job which the AIBS should be doing and perhaps should be prodded to engage in more actively. A third activity was intellectual collaboration, including joint programs, symposia and support of international congresses. Dr. Prosser reported on the meeting of representatives of 14 animal biology societies held on Sunday, August 27th. He also indicated that the plant science societies were considering establishing a deputy directorship under auspices of the AIBS for plant science societies. The following resolutions were passed by the Intersociety Council:

1) Resolved that animal science societies join with the plant science societies in discussions next year on ways and means of resolving problems of routine professional services of societies through additional support of AIBS.
2) The animal biology societies be asked to name an officer or council member to participate in discussions of potential mechanisms for increasing professional society cooperation at the intellectual level.

Dr. Lynn, Representative to the AIBS, next reported on his activities. He especially emphasized the need for instruction from Society members and the Executive Committee, and problems to be carried to the AIBS by the Society Representative. Dr. Prosser called upon Dr. Martin to present his views concerning the status of the Society and its function. Dr. Martin pointed out that the Society was engaged in many and varied activities, that its importance to the members was increasing and that the membership was under obligation to pay its own way. He recommended the raising of dues to $15 or $20 a year to meet the cost and pay for the services that the Society is engaged in.

Dr. Runner expressed the wish that the Sonneborn report on the AIBS should be published. He indicated that publication of the report and its general acceptance by biologists would do much to bring about increased effectiveness of the AIBS.

Dr. Prosser reported on the International Zoological Congress and indicated that the Society members would be given an opportunity to make a dollar a year donation for two years as token support of this congress. It is anticipated that the congress will be a very expensive one and all possible sources of funds must be tapped to support it. Even a token contribution should help the finance committee in obtaining further support.

Dr. Martin moved and it was voted that the Secretary be instructed to extend thanks on the part of the Society to the President of Purdue University and the local committee for the hospitality extended to the Society at the AIBS meetings and the excellent way in which the meetings have been organized and run.

The meeting adjourned at 6:30 p.m.

Respectfully submitted,
Charles B. Metz, Secretary

AMERICAN SOCIETY OF ZOOLOGISTS

Constitution

ARTICLE I: *Name and Object*

Section 1. The name of this organization is the AMERICAN SOCIETY OF ZOOLOGISTS.

Section 2. The purpose of the Society shall be the association of professional zoologists for the presentation, discussion, and dissemination of new or important facts and concepts in the area of animal biology; the adoption and support of such measures as shall advance the zoological sciences, and the promotion of professional exchange and friendly association among all zoologists.

Section 3. These objectives shall be advanced by the holding of regular meetings; by publication of a journal, the *American Zoologist,* and by assisting in the organization and financing of such activities as summer institutes, divisional meetings, symposia, and international congresses. Through direct action by the Society or through such agencies as the National Research Council and the American Institute of Biological Sciences, the Society will support all measures by governmental agencies which will promote its stated objectives.

ARTICLE II. *Membership*

Section 1. The Society shall consist of members, student members, emeritus members, and corresponding members.

Section 2. Members: Any individual who has had scientific training equivalent to the doctorate, who is actively engaged in the field of Zoology, and who has been nominated by a member of the Society shall be eligible for membership. Election to membership shall be by majority vote of the Executive Committee.

Section 3. Student members: Any post-graduate student in biological science who has completed successfully at least one full year of study toward an advanced degree and who has been nominated by a member of the Society shall be eligible for student membership. Election to student membership shall be by majority vote of the Executive Committee. Normally, an individual may not hold student membership for more than four years, and he shall be automatically promoted to membership on his demonstrating to the Executive Committee that he qualifies for membership. Student members shall receive announcements of meetings and all Society publications. They may attend but have no vote at business meetings, nor may they hold office. A student member may present one paper at each meeting of the Society under sponsorship of a member.

Section 4. Emeritus members: Any individual who has reached the age of sixty eight and who has paid dues for twenty five years shall, after written application to the Secretary, be designated an emeritus member. An emeritus member shall have all the rights and privileges of members, but shall be assessed dues at only one-half the rate for members.

Section 5. Corresponding members: Distinguished scientists, living outside North America, who have made outstanding contributions to the science of zoology and who have shown interest in international scientific cooperation may be elected corresponding members. The number of corresponding members shall not exceed one per cent of the number of members. The proposal of a corresponding member shall be made to the Secretary by five members. An affirmative vote of two-thirds of the Executive Committee shall be necessary for election. Corresponding members shall have all rights and privileges of members, save the right to hold office, and shall be exempt from the payment of dues.

ARTICLE III. *Administrative Organization*

Section 1. Officers: The officers of the Society shall be a President, Past-President, President-Elect, Secretary, Program Officer, and Treasurer. The President-Elect shall be elected before one annual meeting, as hereinafter provided, and shall then successively and automatically become President and Past-President during the next two years. The Secretary, Program Officer, and Treasurer shall be elected triennially and shall hold office for a term of three years. The expiration date of the terms of these officers shall be arranged so that only one of the three officers need be elected in any one year.

Section 2. Executive Committee: The management of the Society shall be vested in an Executive Committee consisting of the officers, three members elected from the Society at large, and, *ex officiis,* the Chairmen of the Divisions of the Society. Of the three members at large, one shall be elected each year for a term of three yars.

Section 3. Policy Committee: A committee shall be named annually by the President, after consultation with the Executive Committee, to consider long-range plans and policies for the Society but without power to commit the Society to action, to make recommendations to the Executive Committee, and to perform such other functions as may be delegated to it by the Executive Committee. The Policy Committee shall consist of the President, President-Elect, and three other members, at least one of whom shall be selected from the members at large of the Executive Committee and one from outside the Executive Committee. The Policy Committee shall meet at least once during the period between annual business meetings of the Society, at the expense of the Society, in order to conduct such business as may properly come before it and to report to the Executive Committee.

Section 4. Education Committee: The President, after consultation with the Executive Committee, shall appoint a Committee on Education consisting of six members, each to serve for a term of three years, who shall plan and, subject to approval by the Executive Committee, arrange for the educational programs of the Society, including preparation and revision of bulletins, institutes for teachers,

and any other measures conducive to improvement and facilitation of education in the area of animal science which the Society may deem appropriate to sponsor. The appointment of members of the Committee shall be ordered so that the terms of two members shall expire each year. One of the two senior members of the Committee shall be designated Chairman by the President.

Section 5. Publications Committee: The President, after consultation with the Executive Committee, shall appoint a Committee on Publications consisting of five members, each to serve for a term of five years, who shall study the problems of publication in the field of animal biology, serve as the Editorial Board of the *American Zoologist*, and supervise all other publications formally sponsored by the Society. The appointment of the members of the Committee shall be ordered so that the term of one member shall expire each year. The senior member of the Committee shall serve as the Chairman.

The Managing Editor of the *American Zoologist* shall be appointed by the Executive Committee, after consultation with the Publications Committee. He shall serve for a term of five years, with reappointment for one additional term permissable, and shall be a member *ex officio* of the Publications Committee. Remuneration of the Managing Editor and payment for secretarial assistance shall be determined by the Executive Committee and shall be included as items in the annual budget of the Society.

Section 6. Membership Committee: The President, after consultation with the Executive Committee, shall appoint a Membership Committee of three members, each for a term of three years, who shall review qualifications of individuals nominated for membership of all grades; make appropriate recommendations relating thereto to the Executive Committee, and consider other matters relating to procedures and policies of membership in the Society. The appointment of members of the Committee shall be ordered so that the term of one member shall expire each year. The senior member of the Committee shall serve as Chairman, and the Secretary shall be a member of the Committee *ex officio*.

Section 7. Nominating Committee: At the annual business meeting, the President shall appoint a Nominating Committee consisting of three members who shall submit to the Secretary, at least six months before the next annual business meeting of the Society, a list consisting of not less than two candidates for each office or Executive Committee vacancy. The Nominating Committee must certify to the Secretary that each candidate has declared willingness to run for office and to serve, if elected. These candidates shall be announced in the next News Letter of the Society. Additional nominations for any office may be made in writing to the Secretary by any twenty five members of the Society not later than October 1.

Section 8. Auditing Committee: The President shall annually appoint an Auditing Committee consisting of two members who shall audit the financial statement of the Treasurer and who shall report, for the official records, at the annual meeting on the fiscal status of the Society.

Section 9. Business year: The business year of the Society shall begin on January 1 and end on December 31. The term of office of all elected officers and appointed representatives shall begin on January 1, next after election or appointment, and end, after the number of years designated for each office, on December 31.

Section 10. Elections: Elections of Officers and members at large of the Executive Committee shall be held by mail. The Secretary shall mail ballots to the membership at least two months in advance of the annual business meeting and shall allow one month for their return, the due date being stated on the ballot. The Secretary shall count, tabulate, record the votes and shall notify the candidates for office and the Executive Committee of the results of the election.

In the event that the vote for any candidate should result in a tie, the three members at large of the Executive Committee shall vote by mail to resolve the tie.

ARTICLE IV: *Meetings of the Society*

Section 1. The time and place of the meetings of the Society shall be determined by the Executive Committee. The last meeting of each year shall be designated the annual business meeting. Notices of all meetings shall be mailed to members of the Society at least one month before the date set for the meeting.

ARTICLE V: *Quorum*

Section 1. Fifty members shall constitute a quorum of the Society, and six, a quorum of the Executive Committee.

ARTICLE VI: *Divisions of the Society*

Section 1. A Division of the Society may be organized in any specialized area of animal biology by not less than twenty five members of the Society, upon written request to, and approval by, the Executive Committee. Such Divisions shall have the right to elect their own chairmen and other officers.

Section 2. A Division of the Society shall be entitled to formulate its own bylaws but such bylaws shall not conflict with the constitution and bylaws of the Society.

ARTICLE VII: *Amendments to the Constitution*

Section 1. Proposed amendments of the Constitution may be originated by the Executive Committee or by the members of the Society. Proposals from members shall be submitted to the Executive Committee in writing and shall bear the signatures of at least twenty five members.

Section 2. Voting shall be by mail. The Secretary shall mail copies of the proposed amendment and ballots to the members of the Society and shall allow two weeks for their return, the due date being stated on the ballot. An affirmative vote by two-thirds of the members voting shall be necessary for the adoption of an amendment to the Constitution.

Section 3. The Secretary shall count and record the vote on the amendment and shall immediately notify the Executive Committee of the results. The result of the voting shall also be announced in the next News Letter of the Society.

Section 4. Amendments shall become effective January 1 following their adoption, unless some other date is specifically authorized by the Executive Committee and stated in the Secretary's announcement of the proposed amendment.

ARTICLE VIII: *Bylaws*

Section 1. Bylaws for the Society may be enacted by the membership.

Section 2. The bylaws may be amended or new ones enacted by a majority vote, a quorum being present, at any business meeting of the Society.

ARTICLE IX: *Termination*

Section 1. In the event that the American Society of Zoologists should cease to exist, all funds and real assets of the Society, which remain after legal financial obligations have been met, shall become and remain the property of the American Institute of Biological Sciences.

BYLAWS

ARTICLE I. *Dues*

Section 1. The annual dues shall be eight dollars for members, five dollars for student members, and four dollars for emeritus members.

Section 2. A person may become an inactive member for a specified period of time on written request to the Secretary at least one month before the end of the business year of the Society. During inactive membership, the individual shall forfeit all rights and privileges of membership and shall be exempted from payment of dues. At the end of the specified period of inactive membership, the individual shall automatically be restored to the active roll.

Section 3. A person who, after being billed by the Treasurer, fails to pay dues by June 1 shall be considered delinquent in the payment of dues, and he shall immediately thereafter be deprived of the rights and privileges of membership. A person who shall be two years in arrears in payment of dues shall be dropped from membership. To be reinstated such person must make written application to the Secretary and pay back dues owed the Society for two years plus dues for the current year.

ARTICLE II: *President*

Section 1. The President shall preside at all general scientific sessions and at the business meetings and shall assume overall concern for the affairs of the Society.

Section 2. He shall appoint the members of standing committees of the Society and of such temporary committees as may be desirable.

Section 3. He, together with the Executive Committee, shall define the duties and areas of responsibility of standing and temporary committees where these are not specifically designated by the Constitution and Bylaws.

Section 4. He shall supervise; personally sign, and submit all grant applications, made in the name of the Society or any of its Divisions, for the support of special programs, meetings, institutes, publications, or for any other purpose.

Section 5. Whenever the officers of a number of related societies shall confer on matters of mutual interest to these organizations, the President shall represent this Society or shall delegate representation to a member of the Executive Committee.

ARTICLE III: *President-Elect*

Section 1. The President-Elect shall preside at sessions designated by the President.

Section 2. He shall assume the duties of President in the latter's absence or inability to serve.

ARTICLE IV: *Secretary*

Section 1. The Secretary shall keep the records of the Society.

Section 2. He shall be responsible for all arrangements for meetings not specifically assigned to the Program Officer.

Section 3. He shall be responsible for reporting to the press, particularly SCIENCE and the AIBS BULLETIN, changes in the roster of officers and the important activities of the Society.

Section 4. He shall make purchases and employ assistance as authorized in the budget in order to expedite the business of the Society, and he shall be reimbursed from the funds of the Society for such expenses.

Section 5. He shall be reimbursed from the funds of the Society for expenses incurred in attending meetings of the Society.

ARTICLE V: *Program Officer*

Section 1. The Program Officer shall receive and arrange the titles and abstracts of papers submitted for the scientific programs at meetings of the Society, according to rules set forth in Article IX.

Section 2. He shall, in consultation with the President, appoint local committees and Chairmen to preside over scientific sessions.

Section 3. He shall arrange for and supervise the publication of the programs and abstracts of meetings of the Society in collaboration with the Managing Editor of the *American Zoologist*.

Section 4. He shall make purchases and employ assistance as authorized in the budget in order to expedite the business of the Society, and he shall be reimbursed from the funds of the Society for such expenses.

Section 5. He shall be reimbursed from the funds of the Society for expenses incurred in attending meetings of the Society.

ARTICLE VI: *Treasurer*

Section 1. The Treasurer shall be in charge of all funds received by the Society.

Section 2. Each year during the month of January, he shall mail notices of dues to the members, and he shall receive payments of dues.

Section 3. He, in consultation with the President, shall prepare an annual budget, to cover the fiscal operation of the Society, including as line items specific allocations of funds for the expenses of the

Officers, Standing Committees, Divisions, and Publications of the Society, and he shall submit the budget to the Executive Committee for review and approval before the annual business meeting.

Section 4. He shall disburse funds of the Society as specifically set forth in the approved budget.

Section 5. At the annual business meeting, he shall present a financial statement of the Society as of specific date.

Section 6. He shall make purchases and employ assitance as authorized in the budget in order to expedite the business of the Society, and he shall be reimbursed from the funds of the Society for such expenses.

Section 7. He shall be reimbursed from the funds of the Society for expenses incurred in attending meetings of the Society.

ARTICLE VII: *Duties of the Executive Committee*

Section 1. The Executive Committee shall serve as the governing board of the Society and shall review and establish policies and procedures of the Society in line with the provisions of the Constitution and Bylaws. In issues or on questions, involving major changes in policy or procedure, which are submitted to the membership of the Society for mail vote, a majority of votes cast shall suffice for passage.

Section 2. The Executive Committee shall (a) set the time and place of meetings; (b) advise the President on appointments; (c) review the budget recommendations of the Treasurer and establish the approved annual budget; (d) elect members of the Society as prescribed in Article II of the Constitution; (e) prepare agenda for the business meetings of the Society; (f) appoint a representative of the Society to the American Institute of Biological Sciences, for a term of four years; appoint a representative of the Society to the American Association for the Advancement of Science, for a term of three years; appoint a representative of the Society to the National Research Council, for a term of three years, and appoint representatives of the Society as required to various other boards, councils, and professional organizations for terms to be specified and recorded by the Secretary; (g) appoint the Managing Editor of the *American Zoologist*, for a term of five years and the editors of such other publications as the Society may sponsor for terms to be specified and recorded by the Secretary; (h) name the Managing Editor of the *Journal of Morphology*, for a term of five years, and the Editorial Board, for terms of three years each.

Section 3. The Executive Committee shall meet at the time of each regular meeting of the Society, when feasible on the day before the scientific sessions are scheduled to begin, to conduct such business as may properly come before it and to receive the annual reports of standing and temporary committees of the Society.

ARTICLE VIII: *Vacancies in Office*

Section 1. If for any reason the office of President should become vacant before the expiration of the normal term, the President-Elect shall immediately assume the duties of President.

Section 2. A vacancy in the office of Secretary, Program Officer, or Treasurer shall be filled through appointment by the President for the remainder of the term.

Section 3. If a member at large of the Executive Committee shall be unable to serve on the Executive Committee because of his election to office, resignation, or any other cause, a member at large shall be elected at the next annual election of the Society to serve the remainder of the term so vacated.

Section 4. A member at large of the Executive Committee shall not be eligible for immediate reelection unless he shall have served for less than a full term of three years.

ARTICLE IX: *Program Rules*

Section 1. Titles and abstracts of papers to be presented in person or by title at meetings of the Society must be sent in duplicate to the Program Officer specified on the transmissal blank on or before a stated deadline date. The length, form, and arrangement of abstracts must conform to regulations set forth by the Program Officer.

Section 2. A member may submit no more than two abstracts, only one of which shall be for a paper to be presented in person, at any one meeting of the Society.

Section 3. Except when he shall be specifically invited or required to present a major address, a member shall be entitled to no more than fifteen minutes at any one meeting for the presentation of a paper personally or through introduction of a non-member.

Section 4. A member who sponsors a paper by a student member shall not have his normal allotment of time curtailed by such sponsorship.

Section 5. Student members shall not be permitted to present papers by title.

Section 6. A non-member of the Society may present a paper at a scientific session of the Society, if (1) he is joint author with a member, or (2) if he is introduced by a member, or (3) if he is a member of an organization which is sponsoring a joint session with the Society or one of its Divisions.

ARTICLE X: *Implementation of Constitutional Requirement*

Section 1. In order to achieve the requirement for staggered terms of office for the Secretary, Program Officer, and Treasurer as set forth in the Constitution, Article III, Section 1, last sentence, the terms of office of the incumbent Secretary, Program Officer, and Treasurer shall end, as currently scheduled, in 1961, 1962 and 1962 respectively, and at the expiration of the term of the incumbent Treasurer, the new Treasurer shall be elected to serve for a term of two years ending December 31, 1964.

Section 2. As soon as staggered terms of office have been instituted for the Secretary, Program Officer, and Treasurer, as described in Section 1 above and as prescribed in Article III, Section 1, of the Constitution, these Bylaws shall be automatically amended, without further action by the Society, by the deletion from the Bylaws of Article X in its entirety.

AMERICAN SOCIETY OF ZOOLOGISTS
MEMBERSHIP LISTS

Names are arranged alphabetically in four lists corresponding to the four classes of members: Regular, Student, Emeritus, and Corresponding. The list is corrected to August 1961. The letter or letters following the name show the divisional affiliation of the member as follows:

B Animal Behavior & Sociobiology
D Developmental Biology
E Comparative Endocrinology
I Invertebrate Zoology
P Comparative Physiology
V Vertebrate Morphology

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Errata in Volume 1

P. 55 Fig 2. and p. 56 Fig 4. Read: *Calliphora erythrocephala* instead of *Periplanata americana* in legends of figures.

P. 174 Editorial Board of Journal of Morphology. Read Alvin Novick instead of A. Novikoff.

P. 175 line 27, read Wolfle instead of Wolfe.

P. 321 The symposium on Comparative physiology of excretory organs was supported by a grant from the National Institutes of Health, (not the National Science Foundation).